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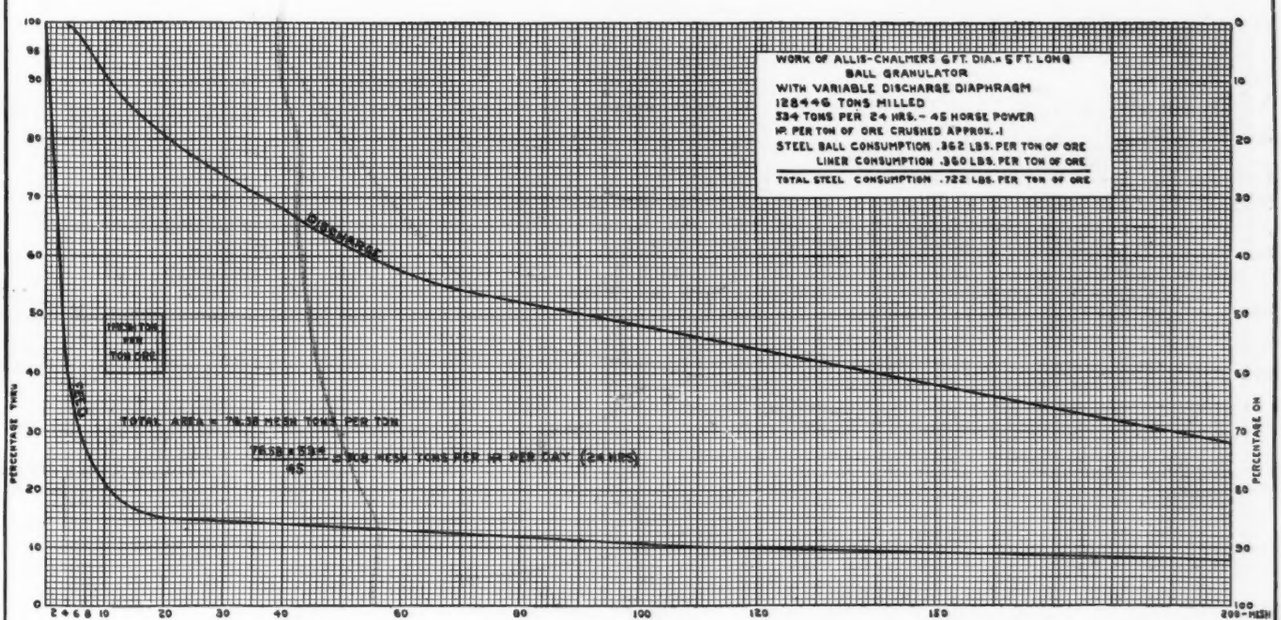
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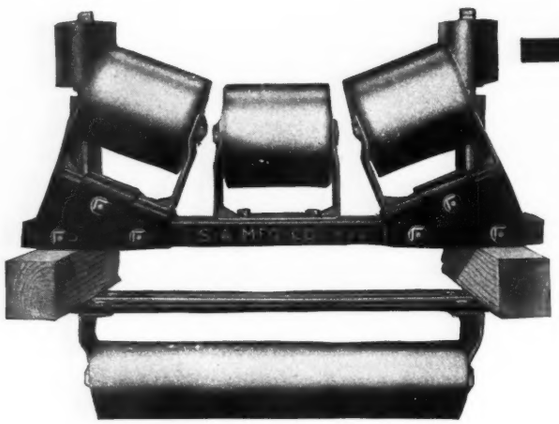

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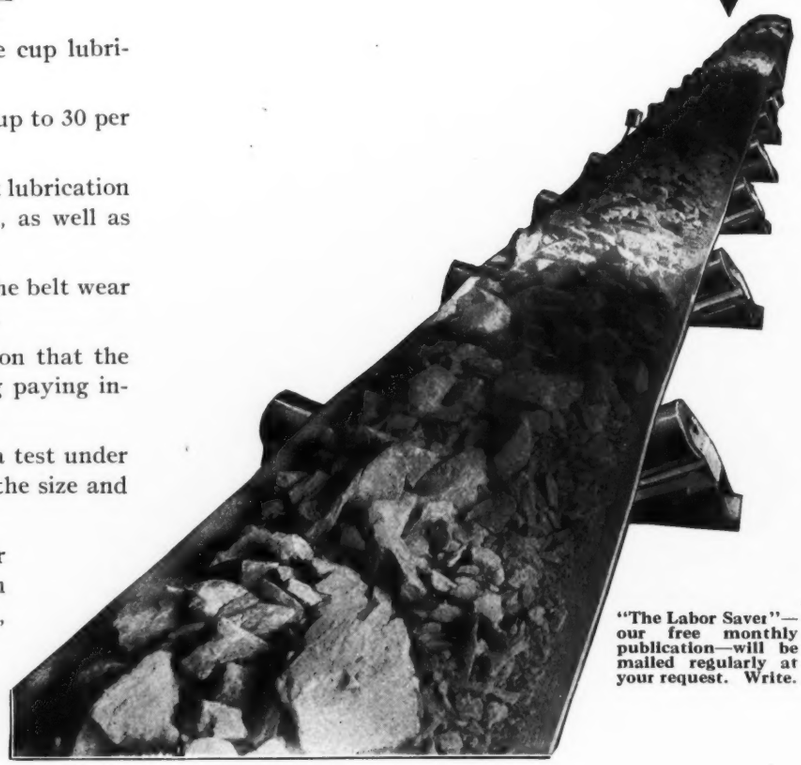

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Engineering and Mining Journal

VOLUME 103 MARCH 10, 1917 NUMBER 10

Metal Mining in Russia

By Sydney H. Ball* and Bela Low†

SYNOPSIS—A review of present status of the metal-mining industry in Russia together with geological descriptions of the various mineral deposits and details of all the principal producing mining companies. Russia stands eighth in the list of world's copper producers, fourth as a gold producer and first in the production of platinum, and has the most important manganese deposit in the world.

A result of the European War will be the further industrialization of Russia and the development of her vast natural resources on a larger scale and at greater speed than during the last decade, which witnessed an unprecedented increase of mineral production in that country. The Russian mining industry in particular is not in keeping with her natural resources, and a considerably larger mineral output can be expected in view of the requirements of the industrial establishments of the country, the introduction of modern mining and metallurgical methods and the desire of Russia to make herself as far as possible independent of imports.

Since the outbreak of the war the necessity of closer commercial relations between Russia and the United States has often been pointed out. American capital is beginning to invest heavily in European countries, and as Russia is more in need of capital for developing her industries than the other great powers, she constitutes a particularly attractive field to financiers. The mining investor, especially, may look favorably upon a country in which so many mining ventures by foreign capital have succeeded. The exploitation of copper, iron, manganese, lead and zinc properties has been highly successful, although that of gold mines, with few exceptions, has been disappointing.

TYPES OF RUSSIANS AND KIRGHESE, THE LATTER THE PRINCIPAL LABORERS OF THE KIRGHESE STEPPES

Foreign financiers, particularly British, have the lead at the present time in this field; prior to 1910, however, French, German and Belgian investors predominated over British. It is said that 25% of the stocks of all gold

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mines in Russia is owned in the British Isles, and in copper mines British capital predominates. The Germans are rather heavily interested in manganese, iron and copper properties; the French, through a sales syndicate, control the platinum industry, while Belgians have invested heavily in the iron industry. German capital has largely confined itself to the Caucasus, the Donetz basin and the Pacific Coast regions; Belgian, to the Donetz basin, while French and English capital have sought all parts of the empire.

Although American capital as yet is interested in Russian mines to but a small extent, American engineers are responsible for many of the notable successes. Under these circumstances details of the metal-mining industry in Russia are of increasing interest to American mining men. This description of all the important metal mines and the conditions affecting mining in each district is the result of compilation of data scattered among various (mostly foreign) publications and of personal observation made during extended trips throughout the Russian Empire.

Table 1 of the Russian metal production for the years 1880, 1892, 1904 and 1913, gives the status of Russian mining at four periods at, roughly, 10-year intervals.

TABLE 1. RUSSIAN MINERAL AND METAL PRODUCTION

	1880	1892	1904	1913
Iron ore	1,003,147 tons	.....	.....	.....
Pig iron	.....	1,072,651 tons	2,972,115 tons	4,547,000 tons
Copper	3,138 tons	5,377 tons	10,900 tons	34,300 tons
Manganese ore	Insignificant	203,460 tons	430,090 tons	1,171,000 tons
Gold	$27,804,400	$25,818,000	$24,627,537	$22,199,000
Platinum	94,776 oz.	141,845 oz.	161,950 oz.	173,642 oz.
Lead	1,112 tons	885 tons	300 tons	1,000 tons
Zinc	4,298 tons	4,372 tons	10,606 tons	7,610 tons

This table shows the great strides that have been made in the last 35 years, in the production of copper, iron and manganese, and that the gold output during that time has decreased, while platinum has increased.

Table 2, compiled from the statistics of the *Metallgesellschaft,* shows the production and consumption of lead, copper and spelter for the 10 years preceding the war. The copper productions for 1914 and 1915 are from reports of the Myed Syndicate:

TABLE 2. RUSSIAN PRODUCTION AND CONSUMPTION OF LEAD, COPPER AND ZINC

	Lead		Copper		Zinc	
Year	Production Metric Tons	Consumption Metric Tons	Production Metric Tons	Consumption Metric Tons	Production Metric Tons	Consumption Metric Tons
1904	300	40,800	10,900	31,200	10,606	23,500
1905	300	41,400	8,900	27,600	7,642	26,000
1906	300	25,000	10,700	23,500	9,610	17,000
1907	100	34,200	14,800	17,600	9,738	17,600
1908	100	44,700	16,800	20,900	8,839	17,800
1909	800	38,400	18,500	21,600	7,945	18,400
1910	1,200	48,800	22,600	28,600	8,631	24,900
1911	1,000	42,900	25,600	32,800	9,936	28,900
1912	1,000	45,600	33,500	40,000	8,763	27,900
1913	1,000	58,800	34,300	40,200	7,610	33,300
1914	.....	.....	30,944	33,424	.....	.....
1915	.....	.....	34,918	.....	.....	.....

Table 3, largely from "The Mineral Industry," shows the production of the other more important metals in Russia during the last 10 years.

TABLE 3. RUSSIAN PRODUCTION OF OTHER IMPORTANT METALS

Year	Gold, U. S. Cy.	Pig Iron, Metric Tons	Manganese Ore, Metric Tons	Platinum, Oz. Official (Crude Metal about 83%)	Platinum, Oz.* Actual
1904	$24,627,537	2,972,115	430,090	161,950	290,120
1905	20,521,587	2,125,000	508,635	167,950	200,450
1906	20,020,862	2,350,000	1,015,683	185,546	210,318
1907	26,518,253	2,763,220	995,282	172,064	310,000
1908	33,143,810	2,768,000	362,303	156,792	250,000
1909	31,889,956	2,871,332	574,938	164,513	275,000
1910	35,566,015	2,740,000	668,050	176,334	300,000
1911	34,550,609	3,593,164	504,000	187,008	280,000
1912	28,852,681	4,197,638	766,000	177,596	300,000
1913	22,199,000	4,547,000	1,171,000	173,642	275,000
1914	24,300,000	.....	652,354	156,775	240,000
1915	.....	.....	.....	.....	200,000
1916	.....	.....	.....	.....	57,860

* Official statistics do not report the large amount of stolen platinum.

These tables show that the metal production is neither sufficient for the needs of the country nor commensurate with its great mineral wealth. They demonstrate, however, the steady and satisfactory progress in copper and pig-iron production and likewise what an erratic industry is Russian manganese mining.

In 1913 Russia produced only 1.7% of the lead she consumed, or less than 0.1% of the world's production in that metal; and 22.9% of the zinc she used, or about 0.75% to the world's production of this metal. The lead and zinc productions should soon reach respectable figures, when the large eastern Siberian companies begin production.

Russia in 1913 contributed 3.4% to the world's production of copper, ranking as eighth, just after Canada, and the production was 85.3% of the copper consumed. The important copper producers in Russia form a trust, the Myed Syndicate. It controls, through its company members and through its purchasing contracts, about 95% of the Russian copper production. Engineers for the last six years have foreseen the day when the Russian copper production would exceed its consumption, but with the commercial expansion to be expected after the war, that day is doubtless still some years in the future. It is not to be expected that the copper production for a few years at least will increase much. In 1914 copper mining, and indeed all Russian mining, was hard hit, as from one-third to one-half of the employees were called to the colors; transportation lines were deranged, and coal and other supplies were most difficult to obtain. Mines in the development stage were particularly unfortunate, as concessions were properly made principally to companies that had reached the producing stage.

Russia is by far the largest platinum producer, yielding, before the war, from 92% to 95% of the world's production. In the decade 1903-12 she is credited with 37% of the world's manganese output, India producing 20% and Brazil 12%. As a pig-iron producer Russia is fifth, being surpassed by the United States, Germany, England and France.

As a gold producer she ranks fourth, after the Transvaal, the United States and Australia, and in total gold production she holds a similar place. Considerably less than 10% of the gold of Russia has come from lodes, and of the large gold producers she is the placer country par excellence. In 1910 the placers furnished 78.4% of the gold and 21.6% came from quartz veins, largely in the Urals. Of the latter 18.9% was derived from mills and 2.7% from cyanide and other chemical processes. The placer quota at present is doubtless greater. In the decade ended 1912 the gold production, through the growing output of eastern Siberia, increased until 1910. The recent decrease is probably greater than the table indicates, as at present a larger proportion of the gold produced finds its way into the Imperial Mint. All gold should legally be turned over to government collectors, who, after deducting the government royalty or tax, pay for it by draft on the nearest important mining center

Formerly the gold which was not registered—that is was stolen from the mines—was estimated to be about 10% of the reported total production. In recent years the amount has decreased relatively, by reason of more stringent laws, and the fact that a greater proportion of the output is from the operations of large companies, especially in eastern Siberia, where the larger proportion of illicit gold was mined. The setback in 1911-12 was due in part to deplorable labor troubles in the Lena District. No great gain is to be expected in the gold output, and unless offset by gold recovered from base-metal refining, the output will probably decrease.

Silver is produced mostly as a byproduct of copper or gold refining, although a little silver comes from the Urals and the Trans-Baikal and the Semipalitinsy provinces. The total production for 1911 was 263,000 oz. and in 1914 the government gold refineries turned out 145,000 oz. silver. As the Altai mines are opened up, silver production should increase.

Table 4 shows approximately the relative importance of the various mining districts as metal producers.

TABLE 4. RUSSIAN METAL PRODUCTION BY DISTRICTS

District	Copper 1914, %	Platinum, %	Gold, 1910, %	Iron, 1912, %	Quicksilver, %	Manganese, % Av. 1904–1913	Silver, %	Zinc, %
Ural	53	100	24	20	...	2	...	...
Caucausus	24	...	...	...	...	75	...	17
Siberia								
Altai	1	...	...	...	...	...	25	26
Kirghese steppes	18	...	...	...	...	...	...	...
Eastern Siberia	...	...	61	...	...	...	...	...
Yenisei	...	...	13	...	...	...	...	...
Poland	...	...	...	10	...	...	...	57
Donetz Basin	...	...	...	68	100	23	...	...
Finland	1	...	...	...	...	...	...	...
Moscow (Central Russia)	...	...	...	2	...	...	...	...
Secondary Metal	3	...	...	...	...	...	...	...
Gold and Copper Refineries	...	...	...	...	...	...	75	...

Effect of Political Conditions

The future of the mining industry in Russia will depend to a great extent on political conditions. The well-known features and policies of the semi-absolute government have held back the intellectual advance of the Russian people and have retarded the industrial development of the country. Now, however, the Russian rulers are anxious to assist industrial undertakings, as is evidenced by the high protective tariff on metals; and this import duty (1c. per lb. on lead and spelter, 7c. per lb. on copper) certainly stimulates mining enterprises potently. However, the largest metal concerns usually deduct from this bonus the freight rate from the mine to Moscow or Petrograd. Early in 1916 the import duty upon gold mining and development machinery was removed, thus inviting development.

Political changes that will remove other obstacles to industrial development are also to be expected. The war has democratized the Russian people and awakened their social conscience, and the government will ultimately have to grant reforms which will result in the training and educating of the Russian workman. This factor is of the utmost importance, as the lack of properly skilled and intelligent workingmen is one of the main reasons for the backwardness of industry. The prohibition of vodka sale has had a wonderful effect, increasing everywhere in the empire the productivity of labor. Perhaps of equal value will be the return to his field of labor of the soldier peasant, used to discipline and acquainted to some degree at least with the wonders of the world beyond the confines of his own neighborhood.

Any discussion of Russian labor is difficult, for in one place the workman may be a Teuton, in another a Russian, in a third a Tartar, and a fourth a Kirghese. With few exceptions, whatever his race may be, his efficiency is low. Labor is frequently done by contract, but the minimum amount of work required is so small and the Russian workman is so used to a low standard of living and at the same time so suspicious of the system, that it does not result in high productivity.

At the present time foreigners are permitted to prospect or mine only within a belt of 60 miles wide on the east coast of Siberia, upon receiving a permit from the governor of East Siberia. This permit is difficult to obtain. Portions of southern Siberia and Turkestan are also partially closed to foreigners. With Russia in alliance with England and Japan such restrictions will doubtless disappear in the future.

Corporation and Mining Law

Russia has no corporation law. If a new company is to be formed, a special charter must be granted by the Council of Ministers. The laws affecting corporations are scattered among criminal, civil and commercial laws, but if the bylaws of a company and its purposes are in conformity with Russian law, its charter is always granted, although in some instances not without unpleasant delay. Restrictions made by the laws can almost invariably be waived by a special permit from the Minister, and a company of standing will usually be able to obtain such permit. A company established by foreigners outside of Russia must obtain permission from the government before starting operations, but in the event that it is officially recognized, may plead in the courts and in other ways has legal standing. Any company formed in Russia, even by foreigners, is a Russian company. The general manager of a Russian company must be a Russian and a Christian. A frequent practice of foreign companies, which are excluded from real-estate ownership in some parts of the empire (Poland, Turkestan and Siberia adjoining China, and a strip 60 miles wide along the Pacific coast), is to create a Russian company to hold its property, the foreign company in turn owning the stock of the Russian company. The extent to which the legal status of such companies is recognized is evidenced by the fact that the Russian subsidiaries controlled by the German General Electric Co., Siemens & Halske and Orenstein & Koppel were, after the war, permitted to continue business, although their relations with their German parent firms had to be discontinued. There is a capital tax on Russian companies amounting to 15 kopecks per 100 rubles (0.15%) of stock, and a graduated tax on profits exceeding 3%, which since the war varies from 5% to 11½% of the profits. (The latter on 20% or over.) There is also at present a heavy income tax on corporations both foreign and domestic.

Recently it has been inexpedient for some of the producing mines owned largely outside of Russia to disburse dividends on account of the depreciation of the ruble. The profit in some instances has been held in reserve or has been used in improvements, or the dividend has been made payable in Petrograd.

The Russian mining law, like that of the United States, is based on the principle that ownership of land extends to the center of the earth. On Crown land (unoccupied government land) surface prospecting is free. To pros-

pect underground, however, a license good for two or three years must be obtained. To operate a mine, an *otvod,* equivalent to a patented claim, must be applied for. In such a case work must be started within one year and production must begin within three years; the interpretation of the words work and production is, however, quite liberal. For gold mining there are special regulations, as to size of *otvod.* Special laws pertain to platinum. Rather strict regulations are in force providing for safety, and detailed reports must be sent to the government district engineer at stated intervals covering accidents, dynamite stocks and consumption, progress underground and an endless number of other things.

Foreign mining engineers can only nominally be in charge of mines; hence they act through a Russian graduate foreman, who is responsible to the government for compliance with the mining laws. The direct responsibility of the man and possible imprisonment in case of serious accident to one of the miners under him leads to excessive and costly precautions. A Russian also is usually delegated to represent foreign companies in financial matters.

An interesting feature of Russian mining administration is the preparation at the beginning of the fiscal year of the *smieta,* a program of the coming year's operations. This has a dwarfing effect on operations, because a manager will not bind himself to produce or to develop more ore than he can easily, and if operations are unusually successful, the strong tendency is to hold them in check to prove that the manager after all was a good prophet. In the same way Russian engineers, in drilling placer ground, frequently purposely estimate the grade lower than it is, to insure a more than satisfactory recovery later.

The Ural Mountain Mining District

The Ural Mountains, a low north-to-south chain of hills dividing European and Asiatic Russia, is one of the richest mining regions in the world. Mineral production, which began with salt mining, dates back over 500 years. At present the most important metal products are platinum, iron, copper and gold. The region is comparatively well developed by railroads and constitutes one of the important industrial districts of the Russian Empire. Mining is chiefly done on enormous estates of feudal origin. Usually each estate has copper and iron mines and furnaces and valuable forests, and in addition may produce gold, platinum and precious stones.

The important gold production of the Urals has considerably and rather steadily declined during the last two decades. The placers are mostly worked out, and in only two districts is lode mining carried out on a large scale, notwithstanding the fact that the Ural district is at present the principal center of Russian lode-gold mining. Nearly all the lode deposits are associated with granite and contain complex sulphides. Gold mining has been adversely affected by the scarcity of labor, many men going to railroad-construction camps and to the platinum fields.

A number of small dredges have operated in the Urals, but many have already been abandoned. The placers are not capable of supporting large dredges, as they have been worked several times by cheap labor, are as a rule small, and the gravel is clayey, making the gold difficult to save. Small leasers (*staratili*) produce a considerable amount of gold with the use of a kind of cradle and sluices, and a number of small washing plants are operated by companies.

The Bereozovsk property, covering about 20 sq. miles, belongs to a Russian corporation, the Bereozovsk Gold Mining Co. It was discovered in 1745, and nine years thereafter a 12-stamp mill was operating on the property. It is 8 miles northeast of Ekaterinburg and produces about $600,000 gold per year. The total production has been about $32,000,000, of which almost 60% has come from placers and 40% from veins. The country rocks, talcose and chloritic schists are cut by a vast number of quartz-porphyry dikes (beresite) from 30 to 150 ft. wide and several miles long. These dikes are in turn cut at right angles by numerous small quartz-filled auriferous fissures from a few inches to 2 ft. wide. About 80% of the ore treated is bought from the tributers under old contracts, payments being made on the basis of gold extracted by amalgamation. The ore treated averages about $9. A few years ago an examination was made, to determine whether the whole dike matter was minable, but the contents were found insufficient. From these veins a number of small rich placers were formed, which have been extensively exploited.

Gold Veins in Granite Porphyry

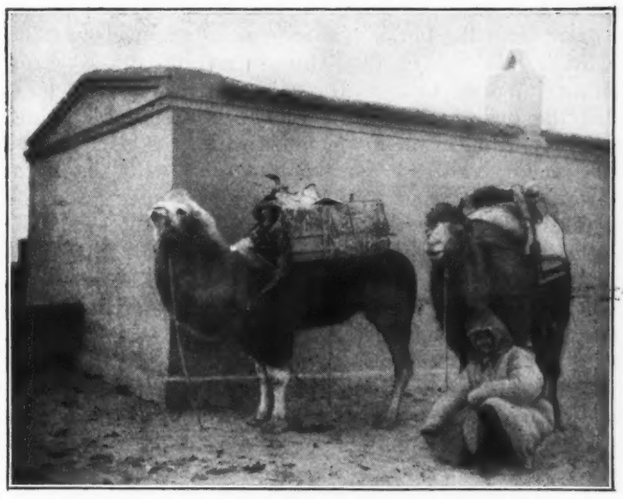
At Katchkar, 50 miles southeast of Miass, in the Government of Orenburg, granite prophyry is transversed by hundreds of east-west quartz veinlets containing auriferous iron pyrite and arsenopyrite. A French company (Société Anonyme des Mines d'Or du Katchkar, capital 13,250,000 rubles) is operating in this district, which was discovered in 1868. In 1897 the company bought from the Podvintseff family, of Petrograd, 48 gold-mining concessions in the Troitzk and Cheliabinsk districts. In 1912 the company produced about $588,000 gold, largely from tailings and dumps, at a profit of $90,000. Reserves averaged only $6 or $7 per ton. In 1913 the company purchased for $250,000 from the Société des Mines d'Or, of Ekaterinburg, 10 mining concessions, aggregating 3½ sq.miles. In 1906 the Orsk Goldfields, Ltd. (capital £920,000), was formed in London, to acquire from the Siberian Proprietary Mines, Ltd. (capital £135,000), a lease on a property in this district owned by Heyman Orkin. The lease was soon given up however. In the same year the Troitzk Goldfields, Ltd. (capital £625,000), acquired from the Siberian Proprietary another property near-by, also once owned by Mr. Orkin. This mine has a modern cyanide mill. In 1913 it mined 39,500 tons, yielding $265,000 and in 1914, 34,190 tons, yielding $223,000. Its reserves were estimated at 23,250 tons, averaging $6.50 per ton, but because of the lenticular shape of the veins, the estimation of ore reserves was difficult. No dividends were paid, and in 1916 the property was sold to Russian interests for about $125,000. In 1913, the Russo-Asiatic Corporation, Ltd., gave up its option on the Miass property.

The Eiderlinsky property, comprising 14,000 acres, is 93 miles east of Orsk and 130 miles south of Troitzk and is owned by the Russian Gold Exploration Co. The geology is quite similar to Katchkar, numerous quartz veins occurring in granodiorite. Mining is carried on by one inclined and three vertical shafts, principally on three veins, which have an average width of 3 ft. The treatment plant consists of 12 chilean mills, each of a ca-

pacity of 20 tons. The ore is free milling, and recovery by amalgamation is 87%. During eleven months in 1913 about 60,000 tons of ore was treated, with an average gold yield of $8.50 per ton.

Platinum in the Urals comes chiefly from two districts—one near Gorablagodat at Krestovozdvishensk, on the river Iss, controlled by Count Shuvaloff, and the other near Nizhni Tagil, belonging chiefly to Prince Demidoff. A third area is that of the Nikolaie-Pavdinsk estate, where in 1914 a modern 7½-cu.ft. dredge was installed. The platinum sands originate from ultra basic ferromanganesian rocks, particularly dunite. The rocks themselves contain such small quantities of the metal that to date they have not proved exploitable, but at the present time a further attempt is being made by the Demidoff estate to work lode platinum. By long-continued decomposition of enormous quantities of these rocks and by the concentration of the metallic content in alluvial deposits, profitable placers have been formed.

Since the beginning of the industry, about 85 years ago, not far from 6,000,000 oz. of platinum has been recovered from 30,000,000 to 40,000,000 cu.yd. of gravel. With the exhaustion of the coarse, rich gravels, mining



CAMEL TRANSPORTATION IN THE KIRGHESE STEPPES REGION

moves downstream into poorer territory; the average content per cubic yard of the gravel, which is from 3 ft. to 6 ft. thick, is now less than 0.05 ounce. The platinum is usually associated with gold, osmium and iridium, the crude metal assaying about 83% platinum, 5 to 7% osmium and iridium, small amounts of ruthenium, palladium and gold, and 10% impurities, mostly iron and copper. About 25 dredges, with few exceptions small and inefficient, are installed, and there are also numerous mills, consisting of a trommel (usually with some clay-disintegrating attachment) and gold-saving tables. Where dredges are not used the gravel is mined by opencuts unless the overburden is thick, then shafts are used. Cradles are also used by the *staratili,* who are supposed to sell the platinum to the operating companies at so low a price that a handsome profit to the company results. It is estimated that in some operations more platinum was thrown back in tailings and black sands than was recovered; and it is expected that at some future time much of the area may be reworked. As the richer gravels are exhausted, the tendency is for the fields to fall into the hands of larger and more powerful companies.

The platinum output is controlled by an Anglo-French syndicate, La Société Industrielle de Platine, which owns several placers, but chiefly secures the output by contracts; Shuvaloff and Demidoff are members of the syndicate. A few years ago a law was passed to tax the exports of crude platinum, but has not yet been enforced. There is a strong nationalistic undercurrent of public opinion, however, demanding that this typically Russian product benefit Russia only and not outsiders. This movement looks to the establishment of platinum refineries in Russia, although practically all the platinum is now refined in France, England, Germany and the United States. Early in 1916 the Russian government prohibited the sale or other disposal of platinum stocks in Russia and requisitioned all. Since then, however, the order has been rescinded, although export since the war began has not been permitted.

Stringent laws have been passed to prevent stealing, as it is estimated that from 30% to 40% of the output is stolen. All dealings in platinum must now be recorded; permits to sell the metal must be secured from the government district engineer, and such permits are granted only to owners of placers.

As a byproduct of the refining of Russian platinum, osmium, palladium and iridium are obtained for which the producer is not paid. In 1901 there was produced 252 oz. of osmiridium but in 1910 only 52 oz. was obtained.

Copper Mines in the Ural Mountains

The Ural Mountain district is the most important copper-producing district in Russia, having yielded 17,300 metric tons in 1913; over 50% of the output of the whole country. Its relative importance as a copper producer is increasing.

The Bogoslovsk estate, with an area of 2000 sq.miles (with an additional area of about 1350 sq.miles of leased crown forest lands), was sold to the Polovzeff family by the government in 1877. In 1912 it was incorporated as a company, with the coöperation of the Asov-Don Commercial Bank. The company owns a standard-gage 120-mile railroad, connecting the property with the Perm railroad and a narrow-gage railroad connecting the various mines and works of the estate. The estate has its own mines trade school and an excellent geological museum.

Copper mining dates from 1745. The deposits are of the contact metamorphic type, the ore being closely associated with augite-garnet rocks, resulting from the contact metamorphism by monzonites and granodiorites of lower Devonian limestones and tuffs. The other wall may be either marble, slaty quartzite, tuff or igneous rock. Ores are chiefly chalcopyrite, with some pyrite and pyrrhotite, but chalcocite persists in one mine to considerable depth. Gold and silver are each present in amounts varying from 6c. to $1 per long ton of ore. Four mines, Vassilyevsky, Bogoslovsky, Frolovsky and Nikitinsky, lying within a belt four miles long, are producing at the present time. The second of these, now nearly exhausted, was situated on two gently dipping beds, which have yielded over 1,000,000 tons of 5½% ore. Vassilyevsky mines irregular lenses of rather small size, but the ore shipped, practically without sorting, averages 13%. The other mines are on vertical columns or tabular lenses of

ore. A little cupriferous magnetite from the iron mines is also treated. In 1914 about 65,000 tons of ore was mined, yielding 4200 tons of copper, at a cost of 8½c. per lb. There is a modern 700-ton smeltery on the property, with converters and an electrolytic refinery. Bogoslovsk is at present the third largest copper producer in Russia, although from 1906 to 1911 it held the premier position.

The Myednorudyansk mine (the name is Russian for "copper mine") is on the estate granted to Prince Demidoff by Peter the Great. It lies near Nizhni Tagil and has an area of 2150 sq.miles. Copper was discovered in 1720, and prior to 1906 the mine was the most important copper producer in Russia. It has produced a total of over 3,000,000 tons of 2% ore. Gold and silver are absent. The orebodies are contact metamorphic deposits at the contact of Devonian limestone and diorite. Surface oxidation has been much deeper than at Bogoslovsk, and the mine is famous for its beautiful malachite specimens and for its rather large number of rare oxidized copper minerals. The ore is either copper sulphide, cupriferous iron ore or clay, containing oxidized copper ore. The mine is probably nearly exhausted, production having fallen to 1400 tons copper per year, but the cupriferous magnetites of the Vissokogoi mine may lengthen the life of the property. The sulphide ore is roasted with wood before smelting. A reverberatory furnace and many ancient Russian shaft furnaces constitute the plant. The mine and smeltery are connected with a broad-gage railroad, 1½ miles long, which is connected with the Perm railroad by a 3-mile branch. Some idea of the size of these Ural estates may be had from the fact that coal is obtained from the Suniffsky mine on the same estate at least 100 miles away.

Contact Metamorphic and Replacement Copper Deposits

The Verkh-Issetsky, operating the estate of Count Stenbock-Fermor, is working two copper mines, the Pyshminsko-Klyutchevskoy and the Kalatinsky. The former, located at Ekaterinburg, is a contact metamorphic deposit. It produced 3,900,000 lb. of copper in 1912, from ore averaging 10% copper. The Kalatinsky mine, situated near Nevyansk, is a pyritic replacement deposit of the Huelva type, averaging a little over 2% copper. It is still more or less in the development stage and is considered highly promising. Pyritic smelting is used for reduction, and production for 1914 was 1000 tons of copper. The Beklorechnsk mine is a large sulphide lens in greenstone with low copper but high precious-metal (about $2.50 per ton) content.

The Sissert Co. Ltd. (capital £1,000,000, of which £755,000 is issued) organized in 1912, has, through owning the entire share capital of its Russian company, the Sissert Mining District Co., Ltd., a perpetual lease on about 1000 sq.miles, situated 30 miles south of Ekaterinburg. The Perm railroad runs through the estate. The Poleskoi and Gumeshevsky mines have been worked for two centuries, and the beautifully drafted maps of the more ancient workings look like etchings. From 1727 to 1870 these and other old mines produced 28,500 tons of copper. At the Gumeshevsky mine, cupriferous clay consisting of decomposed cupriferous contact metamorphic limestone and old fill, averaging about 1% copper, is successfully leached by sulphuric acid. The supply is said to be sufficient for six years. The Sysselsky mine, opened in 1906, was in 1915 reported to have an ore reserve of 68,500 tons, assaying 4¼% copper. At the Degtiarsky mine, explored by drilling, ore reserves are estimated to be 2,400,000 tons, assaying 3% copper and 75c. in precious metals; an additional 700,000 tons is indicated. Genetically, the Gumeshevsky mine orebodies are contact metamorphic deposits similar to those of Bogoslovsk; Degtiarsky is like Kyshtim, while the Sysselsky mine is a somewhat similar sulphide replacement of chlorite schists. The Degtiarsky complex lens system extends into the neighboring Revdinsk estate and the latter is reported to contemplate the installation of a smeltery. The Sissert company uses modern water-jacket furnaces for smelting and in addition makes sulphuric acid from the leaner pyrite of the Sysselsky mine. Copper production in 1912 was 1491 tons; 1316 tons in 1913, and 973 tons in 1914. Besides copper mines, the estate has iron furnaces and iron works, gold vein mines and gold-platinum placers.

The Kyshtim Corporation

The Kyshtim Corporation (capital £1,254,240 in £5 shares and £13,300 debentures outstanding) was brought out in London early in 1907 by the Anglo-Siberian Co., to acquire from the Perm Syndicate an estate of about 2200 sq.miles. It was at that time owned by the Kyshtim Mining Works Co., a Russian corporation which is still the operating company. The mines are 30 miles from Kyshtim, in the Soymonofsk valley. A narrow-gage (36 inches) railroad connects the mine with the Perm government railroad and the various mines with the works. The enterprise has been a great success. The operating company paid dividends in 1912, 1913 and 1914 of £296,421, £311,579 and £210,526 respectively. The mine is now the largest copper producer in Russia. Iron mining began on the estate as early as 1747, gold mining in 1822, and copper smelting was in progress at least by 1837. The copper orebodies are large lenses containing on an average 1,000,000 tons and are pyritic replacement deposits of the Huelva type. The Soymonovsky mine, now abandoned, is of the contact metamorphic type. Production from the Konyukoff, Smirnoff, Tissoff and Amerikansky mines was 7314 tons of refined copper in 1912, 7971 tons in 1913, 7588 tons in 1914, and 8138 tons of blister copper (7642 tons of refined copper) in 1915. The estimated production for 1916 is 6600 tons. The ore treated in 1915 was 361,750 tons, averaging 3.05% copper, $1.80 gold and 1.1 oz. silver. In 1914 the cost was 8¼c. per lb. and in 1915 about 10.4c. which cost is about covered by the value of the precious-metal content and the Russian import duty on copper; so that the current London copper price is clear profit. Reserves were estimated in 1915 at 2,667,000 tons, assaying 2.8% Cu, $1.80 Au and 1 oz. Ag. The Karabash smeltery has a capacity of 10,000 tons copper per year. All the blister copper is electrolytically refined at the property, and after the export of bullion from Russia was prohibited in 1915, a parting plant was constructed. The company sells a considerable amount of iron sulphide to manufacturers of sulphuric acid.

The Tanalyk Corporation (capital £450,000, issued £353,991, and outstanding £198,357 6% convertible debentures) was formed by the Anglo-Siberian Co. in 1912, to purchase the entire share capital of the South Ural

Mining and Smelting Co., a Russian corporation. The property, situated in the Orsk district of the Government of Orenburg, embraces about 44 sq.miles, and in addition the company has prospecting rights over a very large area. Siliceous veins of cupriferous pyritic ore with rather high precious-metal content occur in schists. In June, 1916, the Semeonovsky mine contained reserves of 82,000 tons of oxidized gold ore, averaging about $12.20 per ton and the Tuba mine 48,000 tons of assured and probable ore, with $43.75 in gold and $12.15 in silver. At the same time there were in six mines 106,200 tons of ore, of which a little over 100,000 tons averages 3.43% copper, $5.80 gold and 5.65 oz. silver. There was to be in operation late in 1916 an amalgamating plant to treat the Tuba gold ore; recovery is expected to be about 60%, and the auriferous tailings will be treated in the copper smeltery handling 7000 to 8000 tons of ore per month, which was blown in April, 1914. A small cyanide plant began operation in August, 1915. A narrow-gage railroad connects the mine with the various works. In 1914 the output was 252 tons of blister copper and 12,000 oz. gold. In the year ended Jan. 13, 1915, the smeltery produced 573 tons blister copper, 12,033 oz. gold and 106,678 oz. silver, from 32,000 tons of ore. In the first 8 months of 1916 there was produced 420 tons of copper. The estimated total production for 1916 is 700 tons; the actual and estimated gold output for the same periods is respectively 14,700 and 26,000 oz. The copper is refined at Kyshtim. The cost per ton of ore is about $7, and with copper at 14c. per lb., the profit per ton of ore is $10. The gross profit for 1916 was estimated at about 2,000,000 rubles; the value of products in 1915 was £800,000, and 1916 is estimated at £1,500,000.

The properties that have been described are situated on the eastern slopes of the Ural Mountains. In the plains to the west of the mountains for a distance of about 300 miles are numerous copper deposits geologically interesting, but economically of little importance. The orebodies are usually thin and of low grade; the ore impregnates certain beds of Permian red sandstone; it also occurs as nodules, as veinlets and as replacements of plant remains. The ores include malachite, azurite, cuprite, native copper, black copper oxide, chalcocite, volborthite, pyrite and chalcopyrite. The Kargalinsky mine, 24 miles from the City of Orenburg, belonging to W. A. Pashkiff, at one time produced about 800 tons of copper per year from 3% ore.

Iron Mines in the Urals

The Urals produce approximately 900,000 tons of pig iron per year, which is about one-fifth of the Russian total. In the aggregate the iron-ore resources of the Urals are estimated to be equivalent to about 135,000,000 tons of iron. The chief sources of supply are contact metamorphic deposits, gossans of sulphide-ore lenses, and the limonitized outcrops of iron-carbonate veins and beds. As the Ural Mountains have lignite of inferior quality but no coking coal, the iron ores are smelted almost wholly with charcoal. Although the product is excellent, the depletion of the forests constitutes a very serious problem, and the industry it at a disadvantage in comparison with the iron districts of European Russia, with coking coal at hand, and the more modern plants efficiently run by foreigners. The Ural plants are also farther from the principal markets. The chief products are rails, sheets and castings, although some machinery is made.

The northern part of the mineral belt of the Bogoslovsk estate contains chiefly copper ores, but the southern part near the largest masses of monzonitic rocks contains mainly iron orebodies. Genetically the two are identical, and between them are all gradations. The magnetite orebodies have been superficially decomposed to limonite and red hematite, and these latter are the chief ores used. The company produces 120,000 tons of iron manufactured products per annum and has the largest and most modern steel plant in the Ural Mountains. A Grondal plant is to be installed to separate the copper and other sulphides from the magnetite.

The Gora Blagodat iron-ore deposit, worked since 1730, belongs to the government. It is estimated to contain 17,000,000 tons of magnetite ore, averaging 54% Fe. In an augite-syenite and Devonian limestone, magnetite forms bands as if interstratified with the igneous rock. Magnetite also cements the broken fragments of syenite constituents of which it appears to be a differentiate. The property lies on the so-called "Smelter Line" of the Siberian railroad, and the government's furnaces at Kushva produce 30,000 tons of pig iron per year.

The Vyssokaya Gora iron ore property near Nizhni Tagil, belongs to the Demidoff estate. It consists of lenses of magnetite, the chief ore mined being the surface-altered red iron ore, assaying 65% Fe. Both contact metamorphic deposits and syenite differentiates are present. The ore is smelted at the Nizhni Tagil works, and 100,000 tons of manufactured products of various kinds are produced yearly.

There are many other important iron mines and works in the Urals including the French Kamsky Co.; the Kyshtim Corporation, famous for its wrought-iron figurettes; the Lysvinsky estate of Count Shuvaloff; the Kiselyovsky estate of Prince Lazareff; the Alapayevesky works of Mr. Rukavishnikoff. The iron works of the Sissert company obtain ore from 50 mines, one of which is reported to have reserves of 6,000,000 tons, assaying from 40% to 50% Fe. A large magnetite deposit, the Magnitnaya Gora, is situated 40 miles from Verkhne Uralsk, but because of its isolation is practically idle. At Kyshtim 18,000 tons of sheet iron and castings are made annually.

Other Metals in the Urals

Pyrite mining is a considerable industry, particularly on the Kyshtim and Sissert estates. The production was for many years from 50,000 to 75,000 tons per year, but in 1911 was 162,000 tons, and in 1912, 180,000. The product is used locally in chemical works and sulphuric-acid plants and in various sulphuric-acid plants on the Volga. Pyrite in the Urals costs from $1 to $1.70 per ton at the mine. A small amount of manganese ore is produced in the Urals for local consumption in chemical and steel works. Chrome iron ore, occurring in small lenses in basic igneous rocks, is mined to a small extent in the Urals and is for use also in the local chemical works.

In 1866 an unsuccessful attempt was made to mine nickel on the Revdinsk estate near Ekaterinburg. The vein, 6 ft. wide, with walls of chlorite schist, is reported to have contained 12% nickel. Elsewhere in the Urals, notably on the Verkhne-Ufalei estate, nickel silicate is associated with serpentine.

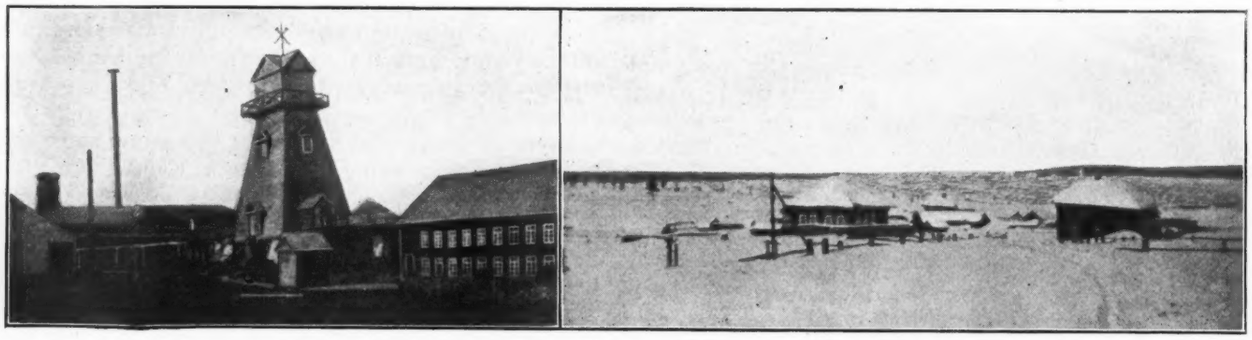
Cinnabar pebbles are not rare in the gold placers of the Urals, particularly at Bogoslovsk and Miass. In 1912 veins of rich cinnabar ore, carrying also gold and silver, were reported on the Verkh Issetsky estate. Gold-bearing antimony veins occur on the Ayatsky estate about 27 miles from Nevyansk, in the Ekaterinburg district.

Mining is not nearly so highly developed in the Causasus Mountain Range as in the Urals; this is chiefly due to the rough topography, transportation problems and lack of timber and coal, but in part to the fact that this district has been pacified and subjected to Russian rule comparatively recently. An interesting feature is the foreign ownership of every important metal mine.

Manganese deposits, the most important in the world, yielding 75% of the Russian total production, are situated in the vicinity of Chiaturi, 126 miles from the Black Sea port of Batum. Development began in 1878, but the output was small until 1885, when the Trans-Caucasian railroad was completed. The manganese was deposited near shore in shallow bays of Eocene age and now occurs as horizontal beds 4 ft. to 8 ft. thick. The ore is pyrolusite, assaying 46% to 50% manganese, 5 to 12% silica and 0.18% phosphorus. Above this rich streak is from 3 ft. to 9 ft. of poorer material. The roof is sandstone, the floor limestone. The better-grade mineral underlies about 44 sq.miles, the whole field covering approximately 55 sq. miles. The reserve tonnage is usually estimated at about 110,000,000. The chief operating companies are the Schalker Gruben und Hütten Verein, of Gelsenkirchen, Germany (which consumes its own ore); Forwood Bros. (English); Panassie (French); and the Industrial and Commercial Co., of Antwerp. This last-named company has a plant that produces 100,000 tons of 53% to 54% washed manganese ore per year. There are numerous other small properties being worked in crude fashion by peasant and nobleman. An interesting feature of the local industry is the Manganese Producers' Association, which levies a small tax on all ore shipped by rail from the district. This tax, collected by governmental permit, is set aside to improve means of transport, to supply water for the mining communities, and in other ways to improve the condition of the laborers. The independent producers sell their ore to brokers, who stock it at so-called "platforms" on the railroad. A large ore stock is a necessary asset to the broker, for if the quantity of ore for export exceeds the capacity of the railroad, government officials apportion the empty cars among the shippers pro rata according to stocks on hand. Before the war Germany bought over half the camp's output of manganese ore.

The Caucasus at one time was the foremost copper-producing region of Russia, but its yield has declined relatively to other districts. In 1907 it amounted to 34% of Russia's total output, but declined to 29% in 1913. Actual production, however, increased from 5100 tons in 1907 to 10,000 tons copper in 1913.

The Caucasus Copper Co. is a British-American company with issued capital £563,500 ordinary shares, £45,280 1st 5%debentures, £500,000 convertible 5% debentures and £745,900 nonconvertible 5% 2nd debentures. It owns the Dazansul mine, probably the largest single copper orebody yet found in Russia. The property was worked by the Genoese five centuries ago. It is in the Artvin district, about 45 miles from Batum, and consists of quartzite, carrying chalcopyrite and a little bornite, the lens being 164 ft. by 328 ft. by 1000 ft. In 1914 about 4,000,000 tons of 2.8% ore was in sight. The mine is an opencut; the soil and other overburden from 10 to 100 ft. thick is removed by hydraulicking. Just before the war a steam shovel to handle overburden was added. The ore is "mill holed" to a traction level. The mine and mill are connected by aërial tram. The concentrates from the mill of 1000 tons daily capacity are smelted and the product converted and refined at the company works. Since its organization in 1900 an enormous amount of money has been spent on the property, probably about $10,000,000, a large part of which was furnished by the American group headed by J. P. Morgan. The company has continuously labored under its heavy obligations, as well as under serious treatment problems, consisting of heavy slime losses and highly siliceous concentrates. In 1914 a 400-ton Minerals Separation plant was added, which tests indicate should solve the difficulties. In October, 1914, the mine was captured by the Turks and shut down, but they were driven out in March, 1915, before having done much harm. The property under its present excellent management should soon become one of the most important producers in Russia. Production was 3030 tons in 1911-12, 2992 tons in 1912-13 and 3936 tons in 1913-14. Costs are about 13c. per pound.



VASSILYEVSKY MINE AND COPPER MINING REGION ON BOGOSLOVSK ESTATE, SHOWING LOW HILLS TYPICAL OF URAL MOUNTAINS

The Kvarzkhana mine is situated in the Artvin district, 40 miles from Batum, and belongs to Siemens Bros., German capitalists, who acquired the property about 14 years ago and have recently completed its equipment. The orebody is a lens of cupriferous pyrite formed by metasomatic replacement at a slate-quartzite contact. It contains 500,000 tons of 4½% ore, with $2 in precious metals. The property is equipped with a 200-ton smeltery, converting plant, aërial tram, etc. The management es-

timates costs at $6 per ton of ore. In 1914 the smeltery was shut down on account of the war.

The Allah Verdi mine is held by a lease expiring in 1944, by a French company, La Société Industrielle et Metallurgique du Caucase. This company started operations in 1888. The mines, which were worked 160 years ago by Greeks, are situated near the railroad from Tiflis to Kars. The ore, chiefly chalcopyrite with quartz gangue, occurs as lenses in quartz-andesite. One of the largest lenses mined, which was 600 ft. long, 120 ft. wide and 36 ft. thick, averaged 3½% copper and about $1 gold and silver per ton. Ore reserves only suffice for three years, and in consequence an energetic campaign of development has been inaugurated. The smeltery has a capacity of 150 tons ore per day, and the charge averages 5% copper. The company refines one-fourth of its product, but is prevented from refining all by an agreement with the Myed Syndicate. Production is stated to be 3500 tons per year, at a cost of about 11c. per pound.

Copper Mines Made Profitable by Low-Priced Oil Fuel

The Kedabek Copper Works, situated 26½ miles from Dalliar, in the Elizabethpol district, belong to Siemens Bros., who began operations there in 1864. The enterprise was unsuccessful until a large sum was spent, chiefly on construction of pipe lines for oil from Baku for use in roasting, smelting and refining the copper, and for steam generation. The smelting capacity is 160 tons per day. The mine is at Mis-Dag ("copper hill") one mile from the works. There are 16 lenticular orebodies in altered quartz-porphyry and andesite, particularly near their contact, and these vary in thickness from 6 ft. to 165 ft., in width from 16 ft. to 165 ft. and in length from 33 ft. to 820 ft. The ore consists of chalcopyrite, pyrite, pyrrhotite and sphalerite, in a barite gangue. The ore, which is sorted underground into two grades, one above and the other below 5%, carries about 2½c. of precious metals per unit of copper. From 1900 to 1912 the mine produced on an average 1750 tons of copper per year, at a cost of 13½c. per lb. In 1914, 14,401 tons of ore was mined, yielding 794 tons of copper, but at present the production is only about 100 tons per year. The smelting ore is practically exhausted, and the management is leaching the low-grade ores on a moderate scale. A large portion of the staff was sent two years ago to the Kvarzkhana mine.

The Ugurchaisky mine is situated in the Zangesur district near the Persian frontier, 130 miles from the railroad station of Evlakh and near the Arak River. It belongs to the Kunduroff Bros., Greeks, residing in Tiflis. Veins 3 ft. to 6 ft. wide traverse diabase or andesite, the best part of the vein averaging 8 in. in width and 15% in copper. Mining methods are crude. There is a small smelting plant on the property. Production in 1913 was 800 tons of copper, which the owners claim yielded a profit of $150,000.

The Synik mine is situated near the Ugurchaisky, and is very similar to it geologically. The property was bought from Melik Asarianz by the Société Industrielle et Metallurgique du Caucase. It is said to have paid the high price of 1,900,000 rubles for it and to have spent on it altogether over 3,000,000 rubles. The production is reported to be only 15 tons of 12% ore per day. The veins, about 20 in number, are from 7 in. to 4 ft. wide; the gangue is quartz, and the ore minerals chalcopyrite, some bornite, tetrahedrite, pyrite and native copper. The ore contains a small precious-metal content.

There are numerous other small producing properties in the Caucasus, especially in the Artvin and Zangesur districts. Near Byelokan the Kunduroff Bros. own apparently very large pyritic lenses of low copper tenor, on which considerable work was done by the Russian firm of Wogau. The Khot-eli mines, once famous, were recently bought by De Boer and Gukossow. They are situated in the Artvin district, 90 miles from Batum. The principal orebody is a cupriferous pyrite vein averaging 5% copper. A plant is to be erected notwithstanding the small reserves.

At Batalpachinsk in the northern Caucasus, near Mount Elberuz, there is a low-grade lead-zinc deposit which has been idle for some time. Near the Black Sea at Sukhum and Gudaut, very narrow high-grade lead-zinc veins exist.

The Alagir mine, the only lead and zinc producer in the Caucasus, was owned by a Russian company of Belgian-Russian capital (Société Minère et Chemique Alagir, capital 4,500,000 rubles; founded in 1896), but in 1914 was being administrated by G. A. Duquenne, of Liége. The mine is at Sadon, 50 miles from Vladicavkas. Quartz veins traverse granites and carry zinc blende and argentiferous galena. Daily production in 1913 was 100 tons of ore, assaying 16% Zn, 6% Pb, 12% Fe and 5 oz. Ag. The reserves were estimated at 100,000 tons. The ore is hand-sorted and the reject concentrated on jigs and tables. The concentrate carries 63% lead and 45% zinc; the recovery being respectively 61% of the zinc and 59% of the lead leaving considerable room for improvement. The smeltery, situated at Vladicavkas, consists of two lead stacks, each of a capacity of 10 tons concentrates per day, and four blocks of zinc retorts, capable of treating 30 tons zinc concentrates per day.

There are several deposits of iron ore of excellent quality in the Caucasus, but lack of transportation facilities as well as of coke or charcoal has prevented their development. Ore reserves are estimated at 19,000,000 tons, containing 8,300,000 tons of iron. One of these, the Dashkesan mine, 20 miles from Elizabethpol, is owned by the Siemens Bros. The ore is magnetite, averaging 65% Fe. The orebody, which varies in thickness from 3 ft. to 70 ft., occurs on the contact of diorite and limestone. At one time this mine was worked for cobalt, which occurred in certain parts of the deposit in considerable amounts. The ore, probably sorted, is said to have assayed 17% Cu, 32% As and ½% Ni.

Settlement and Development of Turkestan

After Turkestan was conquered by Russia in 1881, settlement and development proceeded very rapidly, and compared with other parts of the empire, it is fairly well developed by railroads. Oil and coal are at hand; the geology has been completely described, and many mineral deposits are known; yet there is practically no metal mining. There are restrictions against foreigners, who, for example, are not allowed to travel without special permit of the Minister of War; these restrictions were largely due to the conflict of Russian and English interests as to India and are likely to be removed as a result of the present alliance. A new railroad is being built through Turkestan, and the country seems to offer great possibilities.

Gold placers exist in Bokhara, which were worked in ancient times by Mongolians and Sards. The natives work the placers on a limited scale, but are satisfied with a miserable return for their work. Bokhara in 1905 only produced about 100 oz. of gold. The Russian government made an extensive examination of Turkestan in 1894. The placers apparently are for the most part poor or exhausted. Values in certain placers, however, ranged from 12c. to $1.68 per cubic yard.

At Karamazar, 25 miles northeast of Khodjent, are quartz-barite veins 7 ft. wide carrying galena, zinc blende and chalcopyrite. Galena veins in syenite are known at Mogul-Tau, 16 miles from Khodjent. The Darvasa-Kau mine, 30 miles from Khodjent, was worked by the ancient Persians. The veins are said to vary in width from 1 ft. to 5 ft. and to contain high content of lead and silver.

Although several copper deposits are known, only one attempt has been made at development, which so far has failed. This is the Naukat mine, near Kokand. In a bed of Tertiary sandstone, which can be traced for miles, native copper occurs, as tiny grains, nodules and occasional lumps, the mineralized portion being from 2 ft. to 7 ft. thick. An average content of 1% was claimed—probably double the actual amount. A contact metamorphic deposit between diorite and limestone exists 24 miles from Chilkoff. A large tonnage of magnetite containing chalcopyrite averaging 3% Cu is said to be partly developed.

Siberian Mining Confined Principally to Gold

Owing to various difficulties, such as lack of transportation, severe climate in places, small population and consequent scarcity of labor, etc., Siberia is still largely undeveloped and mining is confined chiefly to alluvial gold mining. Gold was discovered in Siberia in 1830 on the Yenisei, and the total production of Siberia to date is over $1,000,000,000. The auriferous lode deposits are always associated with granitic magmas, but they are usually low-grade. Commercial placers are the result of a long period of concentration of these primary low-grade deposits.

Although several promising prospects exist in the Kirghese Steppes, the only important mines so far developed are those of the Spassky Copper Mine, Ltd. (capital £1,250,000; issued 978,940). A considerable amount of stock in this company, which was floated in 1904 by L. Ehrlich Co., of London, is held in Paris, chiefly by Ernest S. Carnot. The company's copper and coal holdings total about 100 sq. miles. The Yuspenssky mine is situated 500 miles south of Petropavlovsk, a station on the Trans-Siberian railroad. Slate and arkositic sandstone of Permian age are folded into an arc, and along the contact at either tip is an orebody. The main orebody is 250 ft. long and 30 ft. wide, while the smaller is from 30 ft. to 120 ft. long and 30 ft. wide. A band of massive chalcocite and bornite assaying 20% Cu abuts against the hanging-wall slate, and the vein gradually becomes poorer toward the foot wall, and grades into copper-impregnated sandstone. Near the orebodies is a hill of porphyrite, and in addition there is in the vicinity rhyolite breccia. The gangue is sandstone, quartz or barite. In 1913 the shaft was 630 ft. deep and is now being sunk to the 700 ft. level. The smeltery treats 80 to 100 tons ore per day. A concentrator was erected when the high-grade ore was exhausted, but was only ready to operate in the fall of 1916. At that time reserves were estimated to be 429,475 tons of 7.8% copper. The first dividend was paid in 1909-10, and to date a total of 18s. 6d. per share has been paid. The unrefined blister copper carries about $25 in precious metals. In 1911 the cost of producing copper was given as 8.2c. per lb., and in 1912 the production was 3998 tons of copper. A 26-mile railroad connects the copper mine and the Karagandy coal mine belonging to the company. In 1913 the company acquired the Atbasar Copper Fields, Ltd. (registered in 1906 by practically the same capital), which owned a property at Dzhez-Kazgan (Kirghese for "copper hill"), 250 miles from Djousalie, a station on the Orenburg-Tashkent railroad, and 500 miles south of Petropavlovsk on the Trans-Siberian railway. The company controls about 28½ sq. miles of rolling plain. The orebodies above the zone of oxidation had been extensively worked centuries ago by some ancient tribe. In the middle of the past century Cossacks on outpost duty found the mines and Ousherkoff, a merchant of Ekaterinburg, bought them. They passed from him in 1891 to the Riazanoff family of the City of Ekaterinburg, and were subsequently sold to the Atbasar Copper Fields, Ltd. The orebodies consist of Permo-Carboniferous sandstone beds of 3 ft. average thickness, cemented with malachite at the surface and at depth with bornite, chalcopyrite, pyrite and chalcocite. Late in 1915 reserves were stated to be 543,900 tons, averaging 10.7% copper, of which 154,818 tons, averaging 13.1%, is ready to stope. From 35 to 50 oz. silver is to be expected in each ton of copper. A narrow-gage railway to the company-owned Bai-Kanour coal mine, 80 miles west of the copper mine, and a concentrator are built, and equipment for a smeltery is en route to the mine. The production of the old mines of the Spassky company was 2858 tons copper in 1910-11, 3998 tons in 1911-12, 6251 tons in 15 months of 1912-13 and 4683 tons in 1914. It is thus the second producer in Russia. After the war began the company intended to raise new capital to increase its production, but permission to do so was not given by the British Treasury Department, so that these expenditures are being defrayed out of profits. The company owns, together with the Russian firm of Rosenkranz, an electrolytic copper refinery in Moscow.

Mining in the Altai Mountains

The important mining district of the Altai Mountains was recently brought to public notice when two important English companies took up properties. Some of the mines were probably worked in prehistoric time by the Tchoods; Russian mining began as early as 1745. Up to 1860 the district had produced 70,000,000 oz. of silver, 30,000 tons of copper and 500,000 tons of lead, but since then, with the exhaustion of oxidized ores, production has greatly declined. A concession of about 20,000 sq. miles covering the three most important properties—the Zmeinogorsk, Zyrianovsk and Riddersk—was given to the Prince of Thurn und Taxis of Vienna, about 13 years ago. The concession was too large for him to handle, and he finally dropped the Riddersk, and it reverted to the Cabinet. The region is one of tilted Devonian and Carboniferous sedimentary rocks, mostly graywacke, slate, tuff and limestone, intruded by various igneous rocks. In the Kalbinsky Mountains to the west of the Irtysh River are a number of Russian-owned gold quartz veins of promise. Since the recent completion of the Altai railroad to Semipalatinsk, the district is within easy

reach; only one year ago Novo-Nikolayevsk was one week's sleigh ride in winter and the river trip to Omsk in summer was of about the same duration.

The Russian Mining Corporation (organized in 1906, capital £250,000, of which £245,250 is issued) is controlled by F. W. Baker and Lord Harris; the Consolidated Goldfields and Consolidated Mines Selection are also interested. It is practically a successor of the Venture Corporation and was the seller of the Kolchan property to the Orsk Goldfields and the promoter of the Lena. In 1914 the company, with the understanding that it would finance the undertaking, acquired from the Price of Thurn und Taxis the Zmeinogorsk and Zyrianovsk concessions, respectively the northern and southern portions of his vast concession. The first contains about 12,300 sq.miles and the latter 2200 sq.miles. The Zmeinogorsk, the oldest and once the most important mine in Siberia, was formerly the seat of a well-known mines trade school. The deposit is a bedded replacement on the contact of limestone and clay slate cut by porphyry, the slate having been altered to hornstone. The foot-wall hornstone has been extensively mined for gold and silver. In the oxidized zone were ore lenses 1000 ft. long and up to 300 ft. wide, which were worked to a depth of over 600 ft. Below water level the ore is a complex sulphide. In the old days it produced 30,000,000 oz. silver and much lead and gold. The Zyrianovsk is situated 150 miles southeast of the Zmeinogorsk. The orebodies lie between a hanging wall of siliceous tuff and a foot-wall of clay slate, both intruded by greenstone and porphyry. At this contact are numerous irregular lenses of complex sulphides for the most part conforming to the bedding of the wall rock. The mine was worked from 1791 to about 1860. When the property was taken over, there was 50,000 tons on dumps and 150,000 tons developed, assaying 22% Zn, 12% Pb, 2% Cu, 15 oz. Ag and $5 Au. The company has since done diamond drilling, proving ore in one case to a depth of 870 ft., and some underground work has been done. On July 20, 1916, there was on the dumps and partly proved underground 228,000 tons of $48 ore. Old copper mines on this concession have a fair production record, and like the Ridder concession, the mines from which the concessions are named, are the most important of many mines on the property.

The Irtysh and the Ridder

The property of the Irtysh Corporation, Ltd., (having a capital of 2,000,000 shares of £1 each, of which 1,420,969 have been issued, and £1,000,000 convertible 6% debentures, of which £500,000 have been issued), lies between those of the Russian Mining Corporation. This is the Riddersk Concession, which was leased early in 1914 for 72 years on a small royalty basis from the Cabinet (the administrator of the Czar's private properties) by the Russo-Asiatic Corporation (capital £300,000). H. C. Hoover and Leslie Urquhart are prominent in this company, which may be regarded as the continuation of the Anglo-Siberian Co., which financed the Tanalyk and Kyshtim corporations; the Russo-Asiatic Bank, and the Banque du Commerce Privée, of Petrograd, are likewise interested. In November, 1914, the Irtysh Corporation, Ltd., was formed to acquire the Riddersk concession (1600 sq.miles) as well as the Ekibastus coal mine, and it owns all the stock of two Russian companies, the Ridder Mining Co. (capital 16,000,000 rubles) and the Kirgiz Mining Co. (capital 8,500,000 rubles). The latter controls the Ekibastus Coal Field. The Ridder mine was worked from 1778 to 1863, when in the latter year complex sulphides were encountered. The Ridder mine has a slate hanging wall and hornstone (contact metamorphosed shale) foot wall. The orebody is at least 750 ft. long and averages 36 ft. wide, and is known to have a vertical depth of 540 ft. and a long dip of 700 ft. The foot-wall streak of disseminated ore averages 110 ft. in width. The sulphides are blende, galena, pyrite and chalcopyrite. A report of November, 1916, estimates a profit in sight of $52,796,000, from the following ore reserves: Solid sulphide, 945,000 tons, 0.47 oz. Au, 9.7 oz. Ag, 1.5% Cu, 18.1% Pb, 31.2% Zn; concentrating (disseminated) ore, 2,229,000 tons, 0.71 oz. Au, 1.7 oz. Ag, 0.6% Cu, 3.5% Pb, 5.7% Zn. A mill is completed, capable of treating from 1500 to 2000 tons of sulphide ore per month. The diamond drilling is being continued; the mill is to be enlarged to a capacity of 100 tons per day, and plans are being drawn for a 300-ton first unit of a large mill of an annual capacity of 200,000 tons. The mine is being equipped to produce 600 tons per day. A 63-mile narrow-gage (1-meter) railroad from the mine to Ust-Kamenogorsk on the Irtysh River is practically completed. Eight river steamers and 28 barges are also owned.

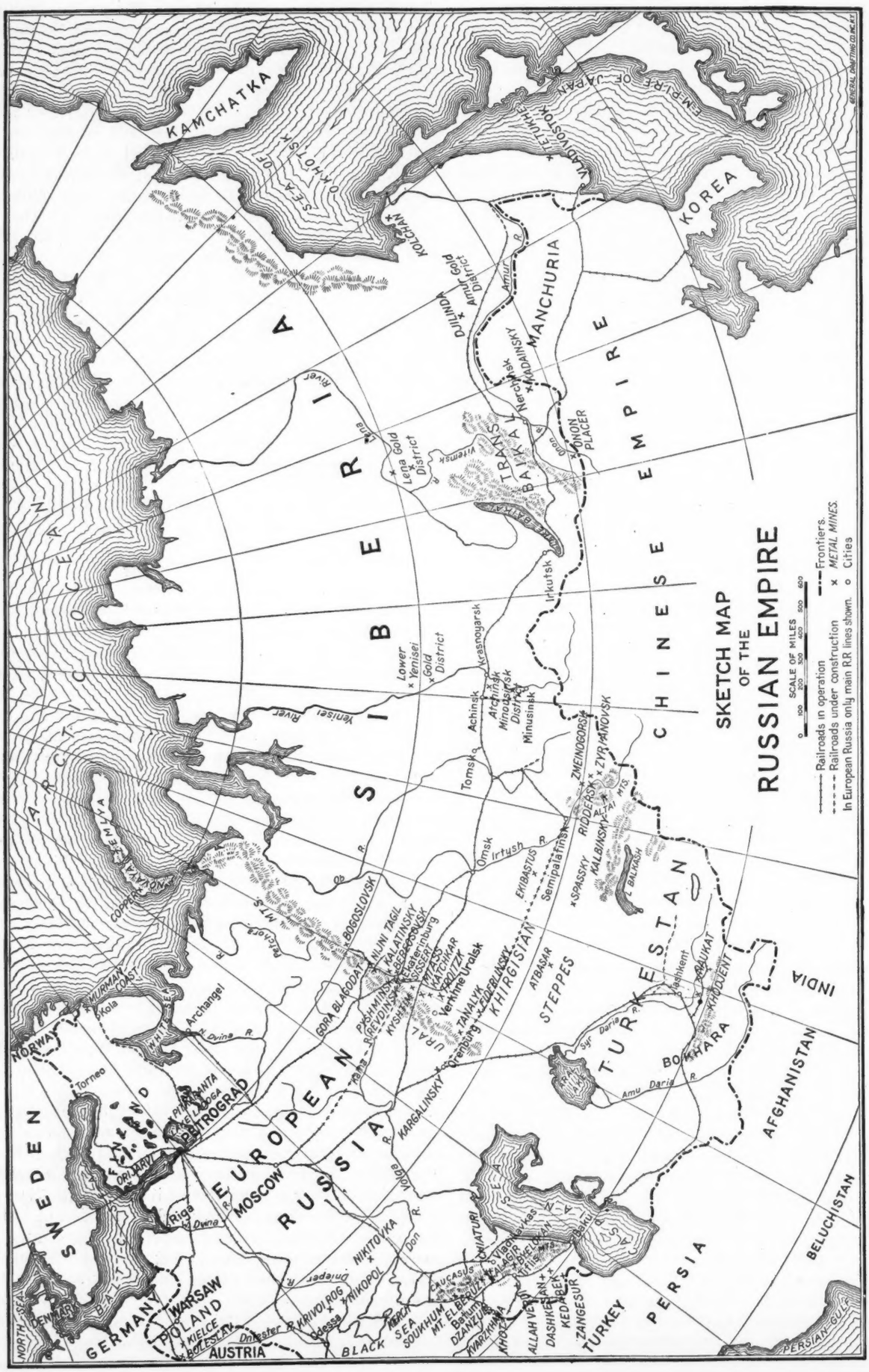
Zinc Smelting at Ekibastus

The present output of the Ekibastus mine, which is connected by an 80-mile broad-gage railroad with Ermak on the Irtysh River, is 75,000 tons per annum. The Ekibastus coal basin is 8 miles long and from 2½ to 3 miles wide, and the seams present are reported to aggregate a thickness of 240 ft. The first unit of the zinc smeltery at Ekibastus has begun operation, and the lead smeltery is practically completed. Lead and bullion refineries are also to be erected. In the first nine months of 1916 there were produced 5100 tons of zinc concentrates and 1600 tons of lead concentrates. In 1917 the technical committee expect to produce concentrates equivalent to 5000 tons of zinc, 4000 tons of lead, 50,000 oz. gold and 80,000 oz. silver.

The Achinsk and Minusinsk district is of no great importance, although the railroad which will probably soon be completed between Achinsk and Minusinsk may lead to its development. Gold occurs in small placers, the largest of which has produced a total of 20,000 oz. The Julia mine at Abakansky was bought in 1911 by the Siberian Copper Co., an English concern, from the Yenisei Copper Co., in which American capital was invested. The ores of the mine are highly siliceous and average 3% copper. To date the mine has failed to pay its way.

The Uriankhai region on the Mongolian frontier is also under the jurisdiction of the government mining engineer at Minusinsk. Since 1839, when placer gold was discovered, the total production approximates $14,000,000, of which one-half has found its way to the Russian mint. The placers are shallow and narrow and of rather low grade. Several futile attempts have been made to work the quartz veins. A 7½-cu.ft. Russian dredge was placed on the Safyanoff placer, but at last accounts was not operating successfully.

The Lower Yenisei district, in the middle of the last century, was the most important gold district of Siberia;



SKETCH MAP OF THE RUSSIAN EMPIRE, SHOWING SITUATION OF THE PRINCIPAL MINING AND MINERAL DISTRICTS

its production in 1847, was over 600,000 oz. Its total production to date is about 14,000,000 oz., but the importance of the district has greatly declined, and there is no large producer at the present time. The gravel treated several decades ago contained $4 per cu.yd. of gravel, while today the content is about 50c. The Draga Gold Co., a Russian corporation (capital 500,000 rubles), installed in 1901 in this district the first gold dredge in Russia. This, like most Russian gold dredges, has been a disappointing venture. In addition there are a number of other dredges in the region. The introduction of dredges appears to offer faint hope of a revival of the industry, unless careful preliminary prospecting is done and then dredges of better design and larger capacity are substituted for the present inefficient types. The lodes from which the gold originates are of low and unprofitable grade.

Gold in the Trans-Baikal

In the Trans-Baikal district the more important of the numerous gold properties are the Onon placers near the Manchurian frontier, which have produced over $9,000,000, and the Blagovietchinsk placer, which has produced over $100,000,000. At one time it had gravel averaging $33 per cu.yd., although in 1913 the grade had fallen to 15c. It is now practically deserted. Only two large companies are working the placers—the Russian Gold Mining Co. and the Nerchinsk Gold Co., Ltd.

Some lodes of the Ural type have been worked, but usually with disappointing results. The Kluchi Gold Mines Co., an outgrowth of the Siberian Proprietary, took over the mine of that name in the Nerchinsk district. The ore was refractory and low-grade, and work has been suspended for nearly seven years.

Near Nerchinsk the Cabinet owns important silver-lead replacement orebodies, lenses, stockwerks and veins, in schists and limestones near intrusive rocks. From 1703 to 1870 there was mined 1,500,000 tons of ore which yielded 40,000 tons lead, 12,000,000 oz. silver and 40,000 oz. gold. All these properties are idle, owing in part to lack of initiative on the part of the Cabinet and in part to increased labor costs and to the loss of a once profitable local market. The Russo-Asiatic Corporation had an option on one of the properties, the Kadainsky mine, but ultimately decided not to take it. The ore is much coarser than the Riddersk, making hand separation of lead and zinc minerals possible.

In 1912 Berlin and Hamburg capitalists and the St. Peterburg International Bank formed a company to exploit a supposedly rich tin lode in the Nerchinsk district three miles from Olovyanka one the Trans-Bailkal railroad. In this region are the following tin placers: Pervonachalny, Kulundinsky, Sharanarsky and Zavitinsky. In the basin of the Chida River are native copper deposits in basic lavas of the Lake Superior type. Similar deposits are known in the Kirghese Steppes.

The Lena district, now the most important Siberian gold district, yields one-third of its gold. It is situated in the Irkutsk province near the Lena River, 300 miles from Irkutsk and is a two weeks' journey from the railroad. The Lena Goldfields, Ltd. (capital £1,405,000, £1,159,297 being issued), was organized in 1908, to acquire through the Russian Mining Corporation, an interest in the Lenskoie (issued capital 1908, 11,100,000 rubles) a Russian company leasing or controlling four placers in the Bodaibo district. The Lenskoie further, owns a railroad and a number of river steamers. The Lena today controls about 70% of the Lenskoie stock; the management, however, remains largely in Russian hands. The partnership has not at all times been conducted without friction. The Consolidated Gold Fields, once the principal stockholder, sold its holdings at a good profit some time ago. The gold-bearing gravels have been worked since 1863, the production having been over $200,000,000. Productions for recent years have been: 1912-13, 851,761 cu.yd., yielding $6.94 per cu.yd.; 1913-14, 873,635 cu.yd., yielding $7.15 per cu.yd.; 1914-15, 974,234 cu.yd., yielding $9.50 per cu.yd. In 1915 the cost was $6.46 per yard. On Oct. 1, 1915, the reserves were estimated to be 2,238,850 cu.yd., averaging a little over $8, and in consequence the property has sufficient high-grade gravel for five years operation which should yield a profit of £800,000. At the present time the introduction of large dredges has been recommended. The property is one of the most important gold properties in the world. The gold of the Lena placers is derived from the disintegration of granitic rocks containing auriferous pyrite and from gold-quartz veins; indeed, the Frodosievsky quartz vein is being actively prospected. The placers occur both as stream and bench placers, having pay gravel from 3 ft. to 6 ft. thick, beneath an overburden that is often 100 ft. thick. It is interesting to note that conditions force this company to buy a considerable quantity of gold each year from its own workmen, who have stolen it from the company's property. Company officials also estimated in 1914 that $50,000 worth of gold was mined from and smuggled off the company property.

Promising Prospects in Amur Province

In the Amur province nearly all affluents of the Amur River carry gold, and with the completion of the Amur railroad the country may be expected to develop under more thorough prospecting. This will particularly be the case if the government withdraws its present restriction against the employment of Chinese and Korean labor. The loss of this efficient and cheap labor has been a hard blow to the local gold-mining industry. The average of the placers is from $1.25 to $2 per cu.yd., although there are streams with $6 gravel. Among the better-known properties is the Djilinda on the Zeya Basin. The Amur Gold Mining Co. (capital 3,000,000 rubles) in 1914 erected a 5-ft. dredge on the Kharga, a tributary of the Zeya; the gravel carries 75c. per cu.yd., and the 1914 production was about $120,000. The Leonovsky placer produced 400,000 oz. of gold in 10 years and the whole section $20,000,000 in that period.

The Kolchan placer (area about 10½ sq.miles), belonging to the Ochotsk Gold Mining Co. and leased by the Orsk Goldfields, Ltd. (capital £920,000; issued 530,007 ordinary £1 shares, 318,000 preferred 5s. shares and 80,000 priority £1 shares), is in this province, 50 miles north of Nikolaievsk. The auriferous gravels are derived from the erosion of the rhyolitic White Mountain. In the season of 1914 one 7½-ft. and one 3½-ft. dredge (a stacker scow converted into a dredge) produced about $307,400 from 928,100 cu.yd., or 33c. per yard, at a reported working cost of 10c. and a total cost of 28c. In 1915 the two dredges washed 784,552 cu.yd., which yielded $399,225.

In the Vladivostok district there are large magnetite deposits at Nikolaievsk and numerous gold deposits are known, especially near Onda Bay. At Tetukhe, near Olga Bay, 250 miles from Vladivostok, valuable lead-silver and zinc deposits have been successfully developed. Work began in 1909, and in 1914 $500,000 was put into a mill. In 1914 there were produced 90.66 tons of lead concentrates and 194.14 tons of zinc concentrates. The calamine is now exported to Japan, but before the war broke out the owners had intended to ship the lead concentrates by steamer to Riga and to smelt them there.

Mineral Wealth of European Russia

While the mineral wealth of European Russia is not great compared with that of Asiatic Russia, there are some important metal mines west of the Urals.

The Nikopol manganese deposit, situated in the southwestern part of the Government of Ekaterinoslav, is geologically similar to those of the Caucasus. The ore is pyrolusite, and the beds vary in thickness from 4½ to 7½ ft. Mining started in 1886, and the district now produces about one-fifth of Russia's total. An embryonic manganese producer is the Gaisïnsk district, near Hoshevatova, province of Podolia (221 miles from Odessa).

The Krivoi-Rog iron district lies near the Donetz coal basin in the governments of Ekaterinoslav and Kherson and is important. It was known to Potemkin in 1770. The ore occurs as martite, specular hematite and magnetite in rather steeply dipping schist, slate and quartzite in two beds, the upper one 125 ft. and the lower one 250 ft. thick. The ore has a high iron content and carries but from 0.01 to 0.02% P. The reserve is estimated at 86,000,000 tons of 62% ore. The district has many mines and is the main source of the pig iron produced in Russia. Foreign companies, largely Belgian and German, and some French, are the main operators in its highly organized steel industry.

Among the operating companies is the Société Metallurgique Russo-Belge, a Russian company of Belgian and Russian capital (20,000,000 rubles). It owns coal mines, iron furnaces and steel mills, and iron mines at Korsak, Moghila and Krivoi-Rog. In 1912-13 it mined 859,006 tons of iron ore, and the company's operations showed a profit of about $4,130,000. The Union Miniére et Metallurgique de Russie, a Russian company (capital 40,000,000 fr.) owned by French capital, has iron ore which carries from 65% to 67% Fe, from one of its Krivoi-Rog mines. The profit in 1912-13 was about $450,000. The Société Metallurgique Dnieprovienne du Midi de la Russie (capital 40,000,000 fr.) has iron mines at Krivoi-Rog, and manganese mines at Nikopol; and in addition numerous coal mines, coke ovens, iron furnaces and steel mills. In 1912-13 the profit was about $4,430,000. The iron-ore production in that year was 1,046,520 tons. As early as 1902 it employed almost 10,000 laborers. The Société Metallurgique Donetz-Iouriewska, founded in 1895 by French and Russians (capital 22,100,000 rubles), operates iron furnaces, steel and iron mills, and iron mines at Krivoi-Rog and Kerch (Crimea). The profit in 1913 was about $2,584,000. The Providence Russe a Marioupol is a company of large capitalization, with iron mines at Krivoi-Rog and at Kerch, Crimea. Profit for 1912-13 was about $1,136,000,

The New Russian Co., Ltd., an English corporation founded in 1869 (capital £1,200,000 ordinary and £574,200 debentures) has coal mines and iron and steel works at Highesoffka, Government of Ekaterinoslav.

In the Crimea, at Kerch, are important iron-ore mines and some of the companies already mentioned have iron mines in that region. The Crimean iron-ore reserves are stated to be 450,000,000 tons of 40% ore. The Société Metallurgique de Taganrog, a Russian-Belgian company, has a capital of 21,000,000 rubles. Its owns iron mines at Kerch in Crimea, with 60,000,000 tons of ore reserve in 1900. It also operates iron furnaces and steel mills. The profit in 1912 was $940,000.

The Nikitovka quicksilver deposit is situated in the center of the Donetz coal basin. It was discovered in 1879, and mining began seven years later. The ore-bearing stratum dips 50 deg. and is Carboniferous sandstone beneath a shale roof; no igneous rocks are near. Cinnabar in crystalline masses with stibnite and sulphur occurs in fractures in the sandstone and also in the underlying quartzite. The ore carries from 0.4% to 1.1% mercury. The mercury production up to 1907 was 300 to 400 tons per year, but since then it has fallen to less than 50 tons, and the mine is probably nearly exhausted. In December, 1912, the owners, Auerbach & Co., were transferring the property to Belgian interests. In the Donetz valley, east of Bachmut, oxidized ores of copper in sandstone were worked in prehistoric time.

Deposits of lead ore exist on the western shore of Murman coast on the White Sea, east of Varangerfiord. The properties have been examined several times, but mining operations have not been inaugurated, although they may become profitable with the completion of the railroad to Kola.

The island of Novaya Zemlya in the Arctic Ocean, inhabited by a few hundred Samoyeds, is the north extension of the Ural uplift. It has a copper deposit, of the Bogoslovsk contact metamorphic type, which belongs to Odessa financiers. A large expedition sent out in 1912 reported favorably on the property, but an attempt to work it the next year failed.

Mines of Russian Poland

Russian Poland in the past was one of the important mining districts of Europe. Mining dates from the Fifteenth Century, and in that century and the succeeding one it was the premier lead district of Europe. Zinc mining began more than 100 years ago; copper and iron are also mined now, and some tin has been produced.

The Silesian zinc deposits of the Tarnovitz syncline, extend into Russian Poland to Boleslav, near the Dombrova coal basin. Even up to 1880 these deposits were among the most important in Europe. A Triassic (Muschelkalk) limestone contains a bed of dolomite, which was in part metasomatically replaced by galena and zinc blende; later these sulphides were oxidized by surface waters. The orebodies are most irregular in form with a floor of limestone and a roof of dolomite. The annual production is about 60,000 tons of calamine and smithsonite. The property is now in territory occupied by Germans. Another important mine of the same type is at Olkusz. As has so frequently happened before, these old lead mines are now chiefly zinc producers.

The Medzianka Gora copper property near Kielce, is a tabular contact deposit between Devonian bituminous slates and granite. It varies from 1 ft. to 15 ft. in thickness and carries from 1% to 3% copper. The ore is

malachite, azurite and chalcopyrite, and the gangue rock is limestone. The mine was opened in the Fifteenth Century, but has been idle for several years, although it is now reported that the Germans are operating it.

Iron occurs in several forms in Poland. Perhaps the chief source is the brown iron ores (35%-45%) and the iron carbonates (27%-35%) of the Keuper formation. The brown ores of the Muschelkalk are also worked at numerous places, and at Bendzin the lenticular masses of ore of this type are 55 ft. thick and carry from 25% to 33% iron. Forty per cent. ores occur in the Devonian at Daleszyei. At one time the carbonate ores of the Carboniferous were worked. In 1862 about 13,000 tons of iron and steel were produced in Poland, and in 1905 500,000 tons. The total reserves are estimated to be 300,000,000 tons of 40% ore. The Polish iron works recently, however, have depended to a considerable extent on ores and on pig iron from other Russian districts.

The French-German-Polish company, Charbonnages, Mines et Usines de Sosnowice, has a capital of 26,000,000 fr. It owns metallurgical works in the Government of Piotrkow and Kielce, as well as coal, iron and lead and zinc mines.

Metal Mines of Finland

Mining for copper and associated tin began at Pitkaranta in Finland in 1820 and continued until 1903.

The annual production was about 750,000 lb. copper and a little tin. The ores occur in a dike-like mass of contact metamorphic limestone enclosed in red granite. This steeply dipping mass averages 15 ft. wide and ore deposits have been mined along it for a distance of 1½ miles. Chalcopyrite occurs disseminated in the metamorphic limestone, while cassiterite is disseminated in certain layers of it and also occurs in granite dikes in it. The properties were bought in 1908 from the Imperial Russian Bank by the Ladoga Lake Mining and Smelting Co., an English concern, but the company was not properly financed and soon suspended operations.

The Orijarvi copper mine, in the Abo province, about 50 miles from Helsingfors, belongs to the Finnish-American Mining Co., composed of Finns living in the United States. The geology is similar to Pitkaranta, and the mine is credited with a total output of $5,000,000 in copper and silver. The company spent $250,000 in exploration work with encouraging results, according to reports. Work had, however, to be discontinued, it is claimed on account of local prejudice and difficulties with the authorities.

In 1836 the Russian government tried to foster placer-gold mining in Finnish Lapland. The maximum yearly production was $37,800 in 1871, and the total production has been only about $340,000. The iron-ore deposits of Finland are estimated to contain about 15,000,000 tons of iron.

Demurrage on Car Shipments

In a pamphlet published by the Interstate Commerce Commission entitled "National Car Demurrage Rules and Explanations" as adopted by the American Railway Association and Tentatively Indorsed by the Interstate Commerce Commission, January, 1916, Rule 8, covers the case of charges of demurrage on cars bunched en route which arrive in excess of unloading facilities as follows:

No demurrage charges shall be collected under these rules for detention of cars through causes named below. Demurrage charges assessed or collected under such conditions shall be promptly canceled or refunded.

Section B—Bunching.

1. Cars for Loading—When, by reason of delay or irregularity of the carrier in filling orders, cars are bunched and placed for loading in accumulated numbers in excess of daily orders, the shipper shall be allowed such free time for loading as he would have been entitled to had the cars been placed for loading as ordered.

2. Cars for Unloading or Reconsigning—When, as the result of the act or neglect of any carrier, cars destined for one consignee at one point are bunched at originating point, in transit, or at destination, and delivered by the carrier lie in accumulated numbers in excess of daily shipments, the consignee shall be allowed such free time as he would have been entitled to had the cars been delivered in accordance with the daily rate of shipment. Claim to be presented to carrier's agent within 15 days.

Selling Machinery in Siberia

A correspondent—a commission house—in Vladivostok sends us this letter and asks us to publish it, which we are glad to do, for we think that it offers advice that may advantageously be taken by concerns that desire to increase sales of American machinery in the Russian market.

We have been dealers in machinery for the last 10 years, beginning with typewriters and ending with almost everything used in installing ice plants and flour mills. All this machinery was formerly made in Germany, and the Germans knew their business. Giving an agency, they would not only furnish Russian catalogs, but also electric or hand-operated models, so that people investing $100 could see with their own eyes how the thing looked and how it worked. This is the right way to sell anything. It can't be done with English catalogs, which are not understood by Russians.

The Germans would also pay a bonus if a certain number of machines were sold in a year, and even would give so many rubles' worth of machinery for starting the business, printing catalogs and advertising. American manufacturers, on the other hand, are so short-sighted even as to refuse to send a sample worth a couple of dollars. Yet they will send for a couple of years catalogs that simply go in the waste paper basket, for they are not understood.

The mining of coal and gold, lead and other ores is done in a primitive way. Gold gravel is dug with pick and shovel and handled with a horse and cart or a wheelbarrow. This pays well, but how much more could be done if worked with capital and machinery?

We request American manufacturers to state what they ask for all kinds of machinery and urge them to send models also. If we take up the agency, we will print the catalogs ourselves.

Gold, coal, cement, wood, lead and iron are plentiful here, and also other mining properties. We would be glad to answer all inquiries and give all particulars regarding these properties, which are not developed owing to lack of labor-saving machinery and capital and to enemy ownership.

Our main point is to get labor-saving machinery for mining, and also flour, cement and ice-making mills.

We shall be glad to send the name and address of the firm communicating the above to anyone who is interested.

Methods of Steel Analysis—The Bureau of Standards has recently reissued Circular No. 14, dealing with "Analyzed Irons and Steels—Methods of Analysis," making certain changes which were found desirable. The determinations for irons and ordinary steels are: Total carbon, graphite, combined carbon, silicon, titanium, phosphorus, sulphur and manganese. For alloy steels methods are given for copper, molybdenum, nickel, chromium, phosphorus, manganese, vanadium, tungsten and carbon

Butte & Superior Mining Co.

The twelfth quarterly report of the Butte & Superior Mining Co., Butte, Mont., covering the fourth quarter of 1916, shows the principal operating features for the quarter as compared with those of the third, second and first quarters as follows:

BUTTE & SUPERIOR OPERATIONS FOR 1916

	Fourth Quarter	Third Quarter	Second Quarter	First Quarter
Dry tons of ore milled	165,470	136,130	161,270	164,500
Average zinc contents, %	14.9855	15.5570	15.9709	15.692
Average silver contents, oz. per ton	6.1669	6.6072	6.7041	6.844
Zinc concentrates produced, tons	44,099	37,333	45,194	45,121
Average zinc in concentrates, %	52.456	52.928	52.9956	53.122
Total zinc in concentrates, lb.	46,265,435	39,519,432	47,901,445	47,938,530
Average silver in concentrates, oz. per ton	20.752	21.500	21.8757	22.018
Mill recovery (% zinc recovered in concentrates)	93.290	93.314	92.989	92.855
Mining cost per ton	$4.5980	$4.9437	$4.4971	$4.0341
Milling cost per ton	$1.9193	$2.1691	$1.7610	$1.5763
Total cost per ton, mining and milling	$6.5173	$7.100	$6.2581	$5.6104

The tonnage of ore treated established a new record, being 29,340 tons greater than for the previous quarter. The decrease of costs in mining and milling is accounted for by differences as between the two periods in wage schedules and supply costs. The grade of ore mined and concentrates produced was practically the same as for the previous quarter.

Replenishment of ore reserves by development amounted to 275,831 tons, or a net increase over the tonnage mined for the quarter of 109,950 tons.

The two new hoist buildings were practically completed and cranes set in them, so that the new hoists can be placed without loss of time upon their arrival. Latest advices, however, confirm further delays in delivery and indicate that the main hoist cannot be in operation much before the end of May. The man and timber hoist for shaft No. 3 may be ready for use some time during March. The new miners' changehouse, having 1800 steel lockers, is completed and in service and is a great improvement over former crowded quarters.

The financial results of operation for the fourth quarter as compared with those of the third, second and first quarters are as follows:

FINANCIAL RESULTS AT BUTTE & SUPERIOR, IN 1916

	Fourth Quarter	Third Quarter	Second Quarter	First Quarter
Net value of zinc concentrates (at mill)	$2,445,877.71	$1,731,670.20	$2,879,568.45	$4,337,412.99
Net value of lead concentrates (at mill) and of residues	396,278.51	190,099.18	246,341.54	264,302.75
Metal inventories and quotations	650,000.00	.....	.....	.....
Miscellaneous income	22,357.36	14,757.71	22,772.34	21,427.21
Total net value	$3,514,513.58	$1,936,527.09	$3,148,682.33	$4,623,142.95
Operating costs, taxes, etc	1,205,445.49	988,625.59	1,086,653.00	1,068,203.27
Profits	$2,309,068.09	$947,901.50	$2,062,029.33	$3,554,939.68

The stated earnings for the quarter included a credit of $650,000 on account of "Metal Inventories and Quotations," this credit being due to underestimates during the three previous quarters of the net value of metals as compared with the cash actually received for them. Adjustment of this account is made from time to time, and as completely as possible during the last quarter of each year, but in the case of the last year there was greater delay than formerly in receiving settlement from the residues containing values other than zinc owing to the difficulty in marketing the residues as compared with former years.

The average price used in estimating returns on spelter for the quarter was 9.7548c. per pound.

After the payment of the regular quarterly dividend of $1.25 and an extra dividend of $5 per share payable to stockholders on Dec. 30, the company had net quick assets of $2,834,246 of which $853,529 was cash, $1,636,359 was the estimated net value of products on hand and in transit upon which final settlements had not been received, and the remainder, $344,358, covered operating supplies, accounts, receivable, etc.

On Dec. 11, 1916, the Supreme Court of the United States rendered a decision in the case of Minerals Separation, Ltd., vs. Hyde, involving a patent upon the process of concentration theretofore employed in the company's mill. As a result of this decision it became necessary, in order to avoid infringement in accordance with the decree, to discontinue the use of less than 1% of oil on the ore in the type of flotation apparatus employed. Steps were immediately taken toward modifying operating methods and conditions to conform to the requirements of the decision by the use of 1% of oil or more. Prior to the end of December the continuous use of more than 1% of oil was adopted and has been applied regularly since that time up to the end of the year. At the time the report was written the full plant had been running for considerably more than a month at normal tonnage and using 1% of oil or more uniformly throughout all flotation operations. The results of this modified practice had been and are satisfactory in all metallurgical respects. Some difficulties were experienced in quickly securing the increased supplies of oils required. This was due in part to the congested condition of transportation. Nevertheless an adequate supply was maintained and under normal operating conditions the most notable difference in operating results was the difference in cost between the smaller quantities of oils previously used and the larger quantity of similar and suitable oils now used. It may be said, however, that the increase in cost of oil supply is not a serious item when compared to the royalties which the owners of the patents in litigation exact for the use of their process in the treatment of similar ores.

Butte & Superior was not a party to the suit mentioned, but after the decision of the District Court of the United States for the State of Montana had been rendered in that suit, an action was instituted in the same court against the Butte & Superior wherein it was charged with having infringed the patent held to be valid in the Hyde case. The hearing was had upon the application of the plaintiff for an injunction *pendente lite,* and upon that hearing the court denied the application for preliminary injunction and provided that the defendant file a bond in the sum of $75,000, conditioned among other things to pay the complainant all damages, profits, costs and expenses that might thereafter be awarded to the plaintiff by any decree or judgment by reason of the defendant's continued use of the patent process, provided that the defendant file a monthly statement of its operations with the flotation process. The defendant complied with the provisions embodied in the order of the court and continued to comply with the order of court. This decision of the court was rendered on Nov. 14, 1913. Thereafter on Nov. 21, 1916, Minerals Separation, Ltd., upon notice, made request of the court that the defendant be compelled to furnish an increased bond and that the defendant be enjoined from extending its use of the process and be further enjoined from declaring dividends or in any wise disposing of any of its assets. Upon a hearing

before the court the defendant requested that it be entirely relieved of the obligations of the order of Nov. 14, 1913, contending that in view of the reversal by the Circuit Court of Appeals of a decision of the District Court in the Hyde case, it should be entirely relieved of obligation to Minerals Separation, Ltd. The court sustained the motion of the defendant. The case remained in this condition until after the decision of the Supreme Court of the United States rendered on Dec. 11, 1916. After this decision, which reversed the decision of the Circuit Court of Appeals of the Ninth Circuit, the plaintiff renewed its motion of Nov. 21, 1916, and asked for the cancellation of the order of court made on said motion. The defendant was granted leave to renew the motion, which will come on for hearing on Mar. 19, 1917.

United Verde Extension Mining Co.

The directors of the United Verde Extension Mining Co., Jerome, Ariz., report to the stockholders for the year 1916 that conditions at the mine are highly satisfactory. The orebody encountered on the 1400 level, in January, 1916, was fully developed on that level by drifts at regular intervals and has an area on that level of over 60,000 sq.ft. Between the 1400 and the 1300 levels this orebody was developed by raises in the ore. Above the 1300 level three raises were run in the ore. At about 60 ft. above the 1300 level the oxidized zone was encountered. No considerable amount of ore in this orebody above that point is looked for. A large amount of high-grade ore in addition to the 700,000 tons in sight between the 1300 and 1400 levels is certain. It is conservatively estimated that 1,000,000 tons of 16% ore is in sight.

A winze was sunk 200 ft. below the 1400 level, which, after passing through 114 ft. of 15% ore and 46 ft. of very low-grade ore, at 160 ft. encountered one of the bars of intrusive waste characteristic of the deposit. At the bottom the winze passed out of the intrusive and encountered a chalcopyrite ore, such as is found elsewhere in the camp. The winze was stopped at the 1600 level, and on account of the difficulty of handling the water, no drifts were run from that level.

The development operations of the year 1916, aggregated 12,193 ft.; in addition, drifting and crosscutting to the extent of 1541 ft. was done in Jerome Verde ground for the Jerome Verde Copper Co. No prospecting is now in progress. The efforts of the company are devoted to mining as much ore as can be shipped, developing the existing orebody and putting the mine in shape for economical production.

So long as the present high price for copper continues, it will be the policy of the company—as far as consistent with good mining—to continue production at the maximum shipping capacity. In common with every other industry, the output of the mine is affected by car shortage and is governed by the available supply of cars.

Smelting contracts have been made with the Copper Queen, Calumet & Arizona and Consolidated Arizona smelting companies, which will take care of present output. An arrangement for refining the product of the company has been made.

Shipments for the year 1916 amounted to 80,159 dry tons of ore containing 2570 oz. gold, 128,467 oz. silver and 36,402,972 lb. copper—an average of 0.032 oz. gold, 1.62 oz. silver and 454.1 lb. copper per dry ton of ore (figures for silver and copper representing 95% of total assay contents).

The company now has an area of approximately 1200 acres, and 19 claims, containing about 300 acres, are still held under option, which will probably be exercised within the coming year.

During the last year there were constructed and equipped a changehouse, blacksmith shop, warehouse and timber framing shed. It is necessary to build an addition to the changehouse for the miners and a new office building to house the staff in the accounting, engineering and laboratory departments. Work on both has begun. Plans have been prepared for a hospital, which it is proposed to erect immediately. To improve living conditions for the employees, it is proposed to lay out a townsite on part of the company's property, where employees who wish to own their own homes can build and where they can live under sanitary conditions.

The site of the new shaft has been determined, plans made for a three-compartment concrete-lined shaft and work on the shaft commenced. A smeltery site has been purchased, plans for a smelting plant are being prepared and work has begun. The site is about 2½ miles from Clarkdale, the present terminus of a branch line of the Santa Fé. It is expected that early in 1918 the company will be smelting its own ore. This will make a considerable reduction in the cost per pound of producing copper. The site for a tunnel has been selected, and work will begin as soon as a power line can be run and electric power is available. The proposed tunnel will strike the mine workings at the 1300 level.

The directors elected for the year 1917 are: James S. Douglas, George E. Tener, Louis E. Whicher, Charles P. Sands, Archibald Douglas, George Kingdon, Paul Armitage, Andrew J. Pickrell, H. Kenyon Burch. The officers elected are: James S. Douglas, president; George E. Tener and Louis E. Whicher, vice-presidents; Charles P. Sands, secretary and treasurer.

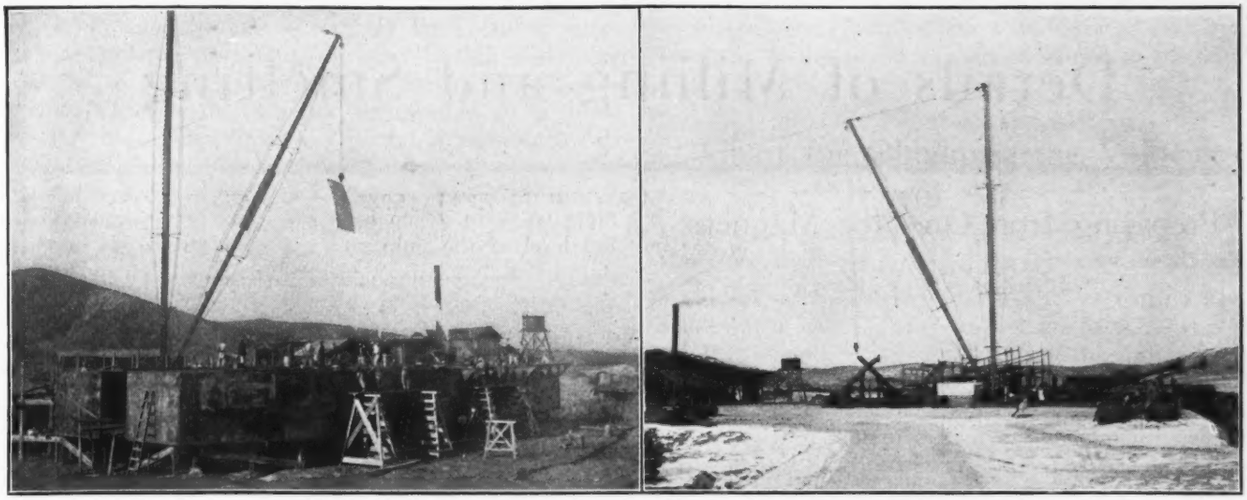
The gross revenue from ore produced during 1916 was $9,949,918; other revenue amounted to $31,154; making a total of $9,981,072. Mine operating expenses and development, freight, treatment, refining and selling amounted to $2,334,746; other expenses, including taxes paid and accrued, totaled $207,809; amounts written off to reserves for depletion of ore and depreciation amounted to $500,417; making total deductions of $3,042,972, which left the net earnings $6,938,100. Dividends Nos. 1 and 2 were paid, amounting to $1,050,000, which left a balance to surplus account of $5,888,100.

Imports of Manganese Ore

Manganese ore imports into the United States in 1916 not only exceeded all former records but were greater than the estimates of the most optimistic, says a report in *Iron Age,* Mar. 1, 1917. The December imports of 49,796 gross tons bring the total for the year to 576,321 tons, as against 313,985 tons in 1915 and 283,294 tons in 1914. This is more than double the 1914 total and nearly equaled the British imports in 1913 of 601,000 tons. The largest month in 1916 was July, with 81,942 tons, and the smallest February, with 8685 tons. The December imports ranked sixth in order of magnitude. The British imports of this ore in 1916 were only 439,509 gross tons.

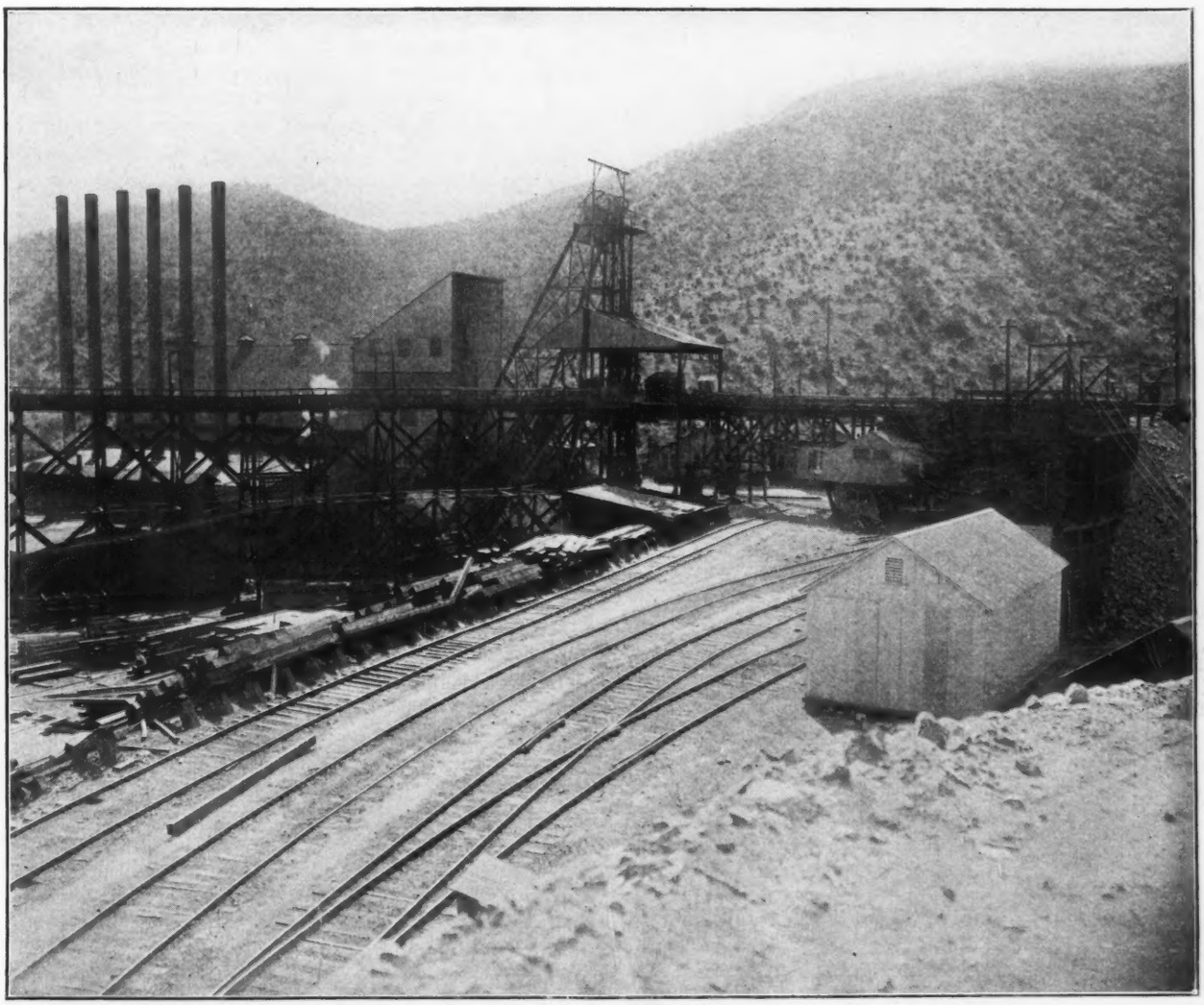
Photographs from the Field

HEADFRAME AT OLIVER SHAFT OF CALUMET & ARIZONA MINING CO., NEAR WARREN, ARIZ.



CONSTRUCTING AN AMERICAN DREDGE IN NORTHWESTERN CHOSEN

After an exhaustive testing of its ground by drilling, the Chiksan Mining Co. ordered this 10½-cu.ft. steel dredge from the New York Engineering Co. The hull is 110 x 50 x 10 ft. and the dredge is designed to dig 25 ft. below water line and to carry a 15-ft. bank. It is equipped with bypass for handling clay and overburden. Photographs taken about Jan. 1, 1917



CALUMET & ARIZONA MINING CO.'S OLIVER SHAFT IN THE BISBEE DISTRICT, ARIZONA

This four-compartment shaft is 1375 ft. deep and is equipped with a 75-ft. steel headframe and a four-cylinder double-reel Nordberg hoist. Levels established at 750 ft. and each 100 ft. lower to the 1450-ft. level. The 1600 level was run from the Hoatson shaft. Ore has been shipped from all levels from the 850 down. Sinking of Oliver shaft was started in 1903

Details of Milling and Smelting

Preparing Iron Ores for Magnetic Concentration

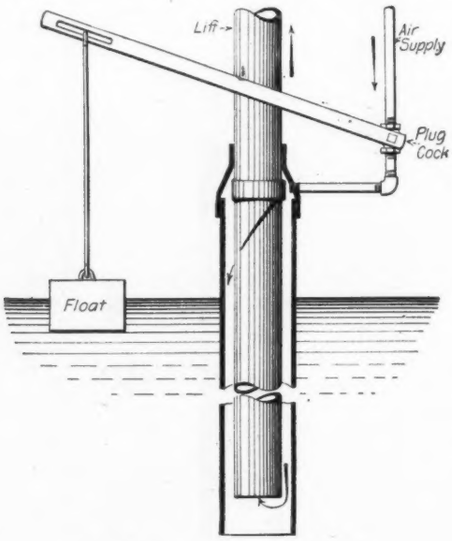
In a paper on "Magnetic Concentration of Low-Grade Iron Ores," read at the New York meeting of the American Institute of Mining Engineers, February, 1917, S. Norton and S. Le Fevre stated the requirements for preparing ores for magnetic concentration.

The authors point out that in the practical application of magnetic separation, the most vital part is the preparation of the ore. It must be crushed so that the crystals of magnetite, or groups of crystals, are sufficiently freed from rock to bring the percentage of iron up to the standard set for shipping ore. On the other hand, it must not be crushed too fine, if it is possible to avoid it, otherwise the blast does not readily pass through in the furnace, or the ore flows over the top. To maintain the best possible physical structure the separation must be made at each stage of the crushing. If the material going to the separators is sized, the strength of the magnets can be adjusted to pick up the ore of more nearly uniform quality, but a separation can be made without very close sizing.

Air Lift for Slime Pulp

By A. W. Allen*

The accompanying diagram illustrates a type of air lift installed recently in South America for the first stage of a compound lift to handle slimed-ore pulp. The



AIR LIFT FOR SLIME PULP

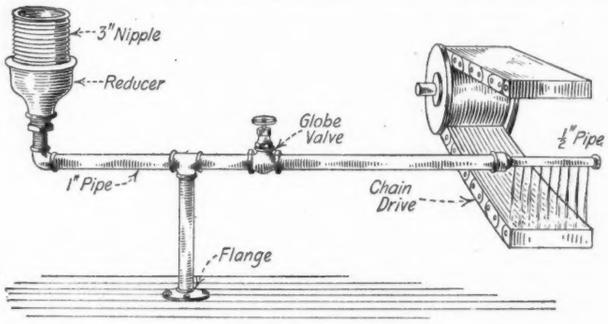
second lift was of the ordinary type with compressed air delivered into the bottom of the lift in the usual way. A comparison was therefore possible as conditions were equal, and results obtained were all in favor of the type illustrated. The dimension of the lift pipe was 3½ in. and of the air pipe, 5 in. The 5-in. pipe was carried just above the level of the pulp and was connected with the lift pipe by a 5x3½-in. reducer. It extended about 2 in. below the level of the lift pipe.

*Metallurgical engineer, 309 Broadway, New York.

A Chain-Drive Oiler

By Arthur C. Daman*

Silent-chain drives, if not properly handled, are a continual nuisance. One of the greatest abuses of a chain drive is in the oiling. I have seen heavy tar-oil used as a lubricant, and in a short time it gummed up so badly and dirt was so impregnated in the chain that its pliability was gone, wear was excessive and breaks became frequent. The various manufacturers recommend a special oil, or at least an oil of special qualities. The chains should be



A CHAIN-DRIVE OILER

cleaned with gasoline at least once a month, so as to clear gritty matter and sticky oil from the links. A chain with proper care should last for years. The automatic constant oiler shown in the sketch was designed by W. J. Wilkey, superintendent of the Nevada Packard Mines Co., and has proved a great success, as the chains are constantly and evenly lubricated. It is made entirely of pipe fittings.

Flotation in Rhodesia

A note of the use of flotation at the Falcon mine, Rhodesia, is given in the description of ore treatment at this mine, by H. R. Adam, in the *Journal* of the Chemical, Metallurgical and Mining Society of South Africa, November, 1916. The Falcon mine, situated at Umvuma, 160 mi. from Bulawayo, Rhodesia, has been producing for more than two years, its monthly output being in the neighborhood of 60,000 lb. of blister copper, 3000 oz. of gold, and 6000 oz. of silver. From 18,000 to 20,000 tons of ore are treated monthly, and of this quantity 14,000 to 15,000 tons consists of sulphide ore, containing 2½% copper as chalcopyrite, and 5 to 6 dwt. of gold per ton. The chalcopyrite is associated with iron pyrite and pyrrhotite.

The crushing system includes ore breakers, trommels and Nissen stamps in the mill. The stamped product is concentrated on vanners, the tailings from which are clas-

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sified and reground in tube mills. The tube-mill product is again concentrated on vanners and blanket tables. From the latter the tailings are lifted by 6-in. centrifugal pumps to cone classifiers, the underflow of which is pumped back to the tube mill, the overflow going to secondary cones preparatory to a partial unwatering for the flotation plant. The result of the gravity concentration is the recovery of 1800 to 1900 tons of concentrates per month, averaging 5% copper and 19 to 20 dwt. gold.

Underflow from the secondary classifiers goes to a pump, the overflow being thickened in Dorr thickeners. The thickened sand and slime with water in the proportion of 3½ to 1 goes to a head box where flotation oil is added to the pump intake to insure thorough mixing. Before entering the first flotation compartment, a sample of the feed is automatically cut out. The flotation plant is of the Minerals Separation type and consists of nine compartments with agitators revolving at 250 r.p.m., producing a froth in the spitzkasten about 15 in. deep. This froth has a copper content ranging from 13 to 14% in the first compartment, down to 3% or 4% in the last, so that the froth, or middling, from the last three compartments is returned to the original feed. From 10,000 to 11,000 tons of tailings are treated every month, the feed value being 1.8% copper and 2.3 dwt. of gold per ton. About 2000 tons of concentrates are recovered, containing 8 to 9% copper and 5 dwt. of gold per ton, by the Minerals Separation unit itself, recovery being about 86% for the copper and 43% for the gold.

The flotation concentrates gravitate to collector vats, where the coarser material settles. The fine concentrates in suspension run to an agitator and then to filter presses. The coarser settled concentrates are shoveled out of the bottom-discharge door, stacked on the surface to dry, and then trucked to the smelting plant. The tailings from the flotation plant are automatically sampled before passing to fine-collecting vats, where slimes are separated for transport to the slimes van, to be hauled to the dump.

Chart for Obtaining the Velocity of Air

The accompanying chart, by Francis J. G. Reuter, in *American Machinist,* is useful for obtaining the air velocity in pitot-tube work from the formula

$$V = 1096.5 \sqrt{\frac{P}{W}}$$

V = Velocity in feet per minute;
P = Pressure due to velocity in inches of water;
W = Weight of air in pounds per cubic feet.

To read the chart and obtain the value V, take on the axis of abscissa a value for P which has been measured with a pitot tube or a similar instrument. From P's value run vertically to an oblique line representing the value for W; from the intersection of those two lines run horizontally to the curve. From the intersection on the curve run vertically to an oblique line 1096.5 in., and from that intersection run horizontally to the ordinate V. If the intersection is found on the first "1096.5 line," the value of V is read from 0 to 2400. If the intersection is found on the second "1096.5 line," V the scale number from 0 to 2400 plus 2000. Similarly 4000 is added for the third and 6000 for the fourth line.

An example is shown by the dotted lines, having P = 0.4 and W = 0.1. The intersection comes on both the first and second "1096.5 line." From the first intersection line V read 2193; from the second, 193 + 2000 = 2193, which is the velocity in feet per minute.

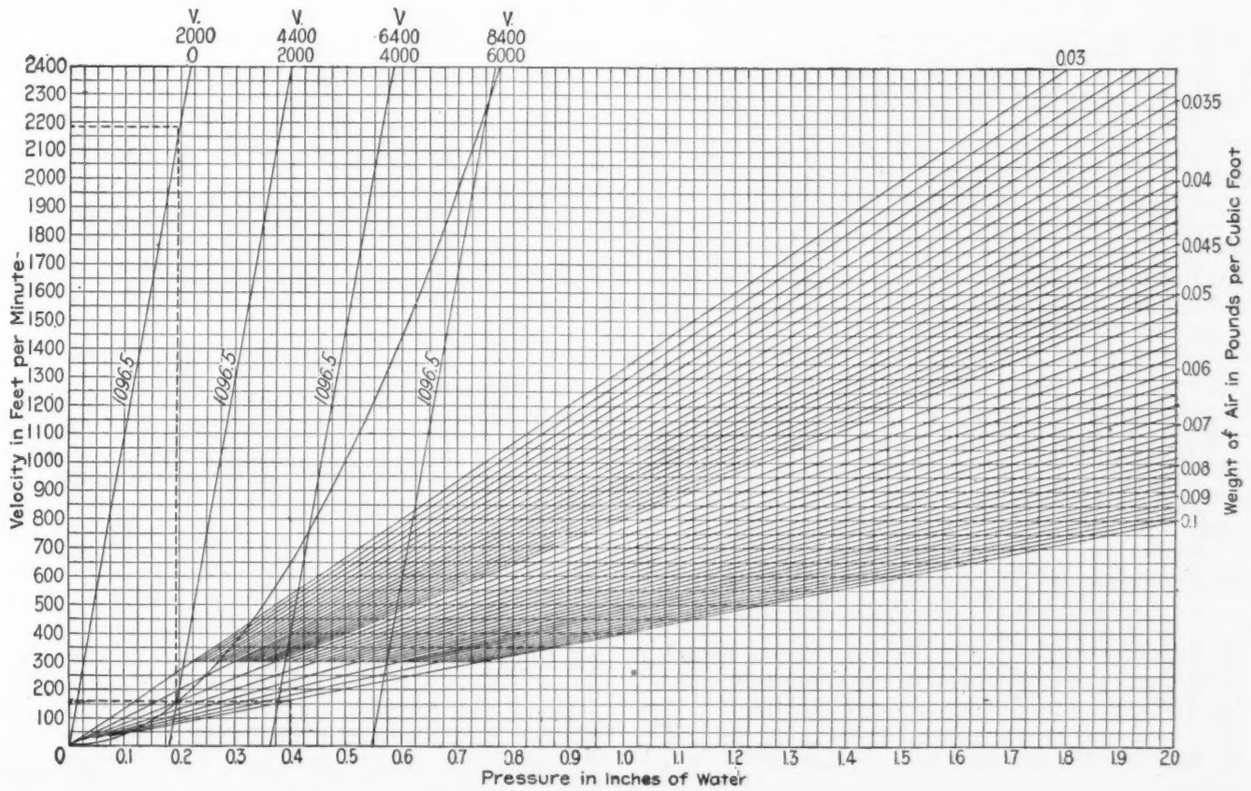
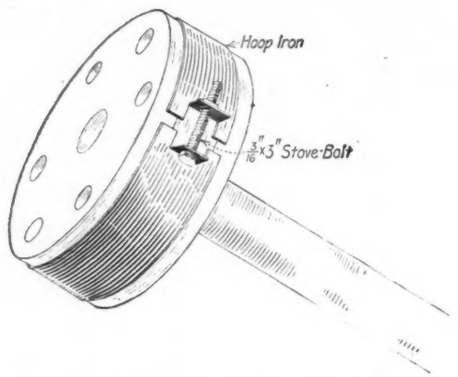


CHART FOR OBTAINING VELOCITY OF AIR IN PITOT-TUBE WORK

Details of Practical Mining

Clamp for Piston Rings

There are probably few power plant operators or operators of gasoline engines who have not lost patience in trying to enter a piston and rings into the cylinder. It is a hard task at best. E. L. Davis[1] described in *Power* a convenient method by the use of a piece of band or hoop



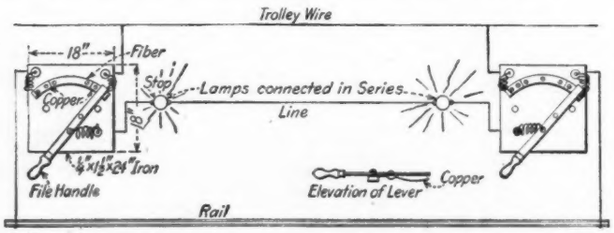
BAND OF HOOP IRON AROUND PISTON

iron about three-fourths the width of the piston and about ½ in. shorter than the piston. In each end of the strap a 3/16- or ¼-in. hole is drilled and ½ in. of the strap bent up. A bolt about 3 in. long, threaded nearly full length, is then put in and the band is placed around the piston and drawn up with the bolt. This holds the ring and makes it easy to insert the piston.

Signal Lights for Mine Locomotives

The accompanying diagram from *Coal Age* shows a system of signal lights employed by R. Thomas Kirk, chief electrician of the Federal Coal Co., of Straight Creek, Ky., to safeguard the men who operate mine locomotives. The switch boards are inexpensive, considering the important part they play in the matter of safety.

One conductor is all that is necessary; and this can be made of an old burned-out field coil or, better yet, a No.



A PRACTICAL SYSTEM OF SIGNAL LIGHTS

18 B. & S. insulated wire. The signal lights are manipulated as follows: When an incoming locomotive passes the first switchboard, the motorman throws the lever and thus opens the circuit, thereby blocking the road. On reaching the next switchboard, he throws its lever, which closes the circuit, causing the two 125-volt lamps to burn and showing the road is clear for following locomotives.

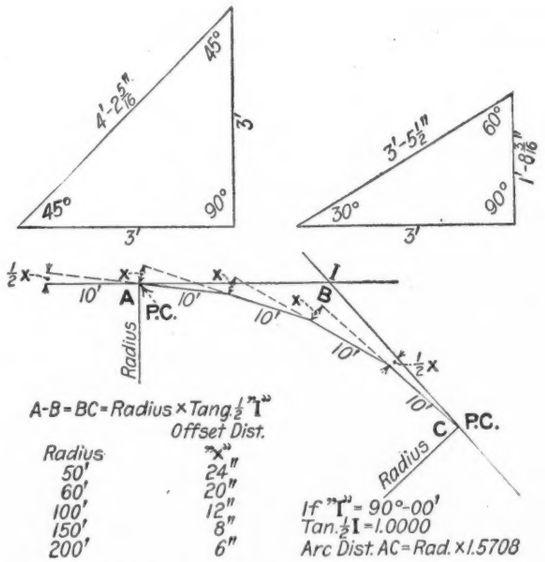
The lights should be placed close to a siding, so that the motorman can clear the road for other locomotives. It should be noticed carefully that the lights are so arranged that they burn when the road is clear and are out when the road is blocked.

Each switchboard can be made of a well-seasoned board or an old piece of slate or marble and should be placed on a timber in some convenient place, so as to be within easy reach of the motorman. This system of lights is being used efficiently in both the Barker and Glendon mines of the company; each light doing away with the services of a trapper boy.

[1]Rosedale, Kan.

Laying out Angles and Curves in Mine Work

Mine foremen and superintendents are often called upon to lay out many of the most commonly used angles and curves in mine track underground. A very simple way to lay out angles without the use of the transit as shown in the accompanying drawings is given by O. H.



METHOD OF LAYING OUT CURVES

Hampsch[1] in *Coal Age*. The methods of laying out 30-, 45-, 60- and 90-deg. angles as here shown are self-explanatory.

The method of laying out simple curves in mine work is as follows: After the point of curve *PC* has been determined, measure back a distance of 10 ft. and make an offset equal to one-half of the offset distance *X* in the direction the curve is to be driven. After driving ahead

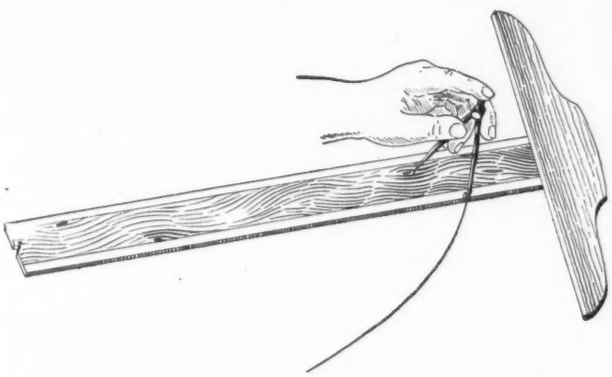
[1]Piney Fork, Ohio.

10 ft. on these sights, set over distance X from the second point, or the PC, and drive ahead another 10 ft., making the offset the same as before. The first and last offsets are always equal to one-half the distance X.

Although other distances in proportion to the ones shown on the drawings can be used, the dimensions shown will be found most convenient. Ordinary sight strings or plumb bobs hung from spads are used for line.

A Drafting-Room Kink

A good drafting-room kink was shown by Jan Spaander of Brooklyn, N. Y., in a recent issue of the *American Machinist* to combine a T-square and compass to obtain a beam compass for striking large arcs. A small V-groove is cut in the end of the T-square and forms a rigid center

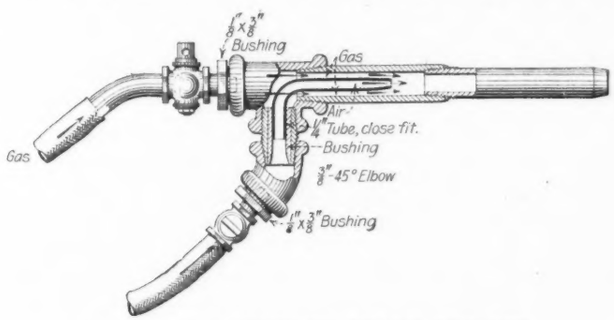


METHOD OF USING T-SQUARE AS A BEAM COMPASS

to revolve the T-square around a pin in the board; and somewhere on the square, near the circle to be drawn, stick the sharp point of the compass firmly in the wood, rest the pencil or the ruling pen on the paper and against the edge of the square. Then take hold of the scriber and hold it firmly against the square and revolve, cutting the desired arc.

Blowpipe Made from Pipe Fittings

The illustration, by H. H. Parker[1], in *Power*, shows a blowpipe for soldering, brazing, etc., made from pipe fittings. A copper or brass tube about ¼ in. diameter is filled with melted lead and given a right-angle bend so



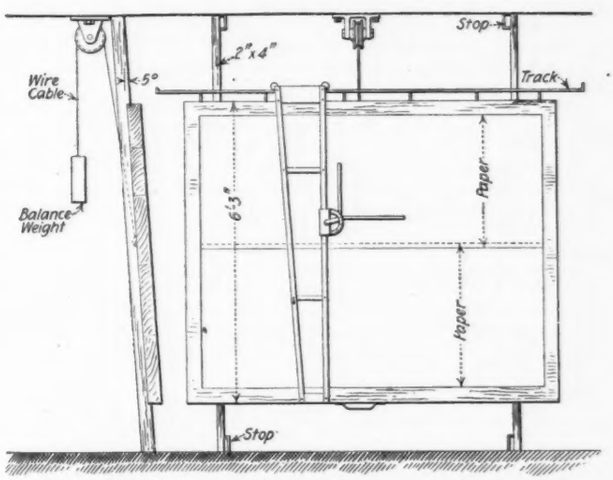
BLOWPIPE ASSEMBLED READY FOR USE

that it will go into a ⅜-in. tee as shown, after which the lead is melted out. A brass or fiber bushing is then driven into a ⅜-in. short nipple and drilled out to take the bent tube, which should make a close working fit, and the tube is driven into the bushing and the bushing screwed into the tee, the tube turning in the bushing while the nipple is being screwed in. A ⅜-in. nipple about three inches long is then screwed into the end of the tee over the air nozzle, and a ⅛x⅜-in. bushing is screwed into the other end. The air tube should be adjusted centrally in the ⅜x3-in. nipple. Valves or cocks are used to regulate the flow of air and gas into the nozzle. The apparatus has been found to work best when the air flows through the bent tube as shown and the gas is led through the straight portion of the tee. Any size or shape of nozzle may be used, depending on the character of work to be heated.

[1]Oakland, Calif.

Drawing Board for Large Drawings

An arrangement of drawing board for handling large drawings which has been used satisfactorily for several years is described by H. E. Beard[1] in the *American Machinist*. The outfit consists of a large board and a standard make of drafting instrument, as shown. The board can be made any length to suit the individual case. They have been used 8, 12 and 16 ft. long. The arrange-



ARRANGEMENT OF THE BOARD FOR LARGE DRAWINGS

ment can be raised or lowered by using the foot in the stirrup fastened to the bottom edge.

The paper, after two strips the required length have been cut and pasted together, is held on the board with a few thumb-tacks placed about 12 in. from the top edge. It is then dampened with a piece of waste dipped in water, after which the edges are coated with mucilage, the tacks are removed, and small wooden strips are nailed on, to hold it until dry and ready to use. When fastened to the board in this manner, the paper gets very tight and makes a good smooth surface to draw on.

Learn About First-Aid Training from Mines Circular No. 23 of the Bureau of Mines. This circular has been prepared to interest miners in first aid. If you are interested, write the Director of the Bureau of Mines, Washington, D. C., for this handbook on advanced first-aid work, which fully explains first-aid methods. Ask your boss to place you in the first-aid class, if there is such a class organized at your mine. If there is not, tell the boss he ought to organize one. Take first-aid and mine-rescue training the next time one of the mine-rescue cars of the Bureau of Mines visits your mine.

[1]Waynesboro, Penn.

Company Reports

Wettlaufer-Lorrain Silver Mines

The annual report of the Wettlaufer-Lorrain Silver Mines, South Lorrain, Ont., for the year 1916 shows a loss for the year ended Dec. 31, 1916, of $28,314. The balance on hand Jan. 1, 1916, was $157,466, which leaves a balance on hand Jan. 1, 1917, of $129,152.

During the year the properties of the company were operated under a lease to the Comfort Mining and Leasing Co., Ltd., and royalties amounting to approximately $8250 were received. The lessee performed some development work, but no important discoveries were made. This lease expired Feb. 17, 1917, and the lessee has not availed himself of the privilege to renew, and unless a new lease is made the looking after and operation of the property will again fall to the company.

New Idria Quicksilver Mining Co.

The annual report for 1916 of the New Idria Quicksilver Mining Co., California, shows net profits for the year 1916, $419,235, from which dividends amounting to $400,000 were paid. During the year 10,828 flasks of quicksilver were produced, which were sold at an average price of $89.57 per flask, as compared with a production of 6250 flasks sold at an average of $74.21 in 1915.

The ore worked during the year came from the upper levels and dumps of both the New Idria and San Carlos mines. The completion of the aërial tramway during the year from San Carlos Mountain to the Idria furnaces allowed the transportation of ore in small cars by gravity at a very low cost. The length of this cable tram is about a mile. The crushing mill and concentrating plant, which enable the working of lower-grade ores than heretofore, worked satisfactorily. Several changes in the concentrating and smelting plants, which will give a larger percentage of extraction, thereby reducing cost and increasing production, are under consideration. Another aërial tram from the Idria mine to the furnaces is in contemplation and will probably be installed early in 1917.

St. John del Rey Mining Co.

The 58th half-yearly report of the directors of the St. John del Rey Mining Co., Brazil, was presented at a general meeting of the company, held Dec. 6, 1916, in London. The report covers six months to Aug 31, 1916, which is the first half of the company's fiscal year. The profit for the half-year was £72,199, which compares with £79,718 for the corresponding period of 1915. The balance brought forward at the beginning of the semester was £7574, and the balance carried forward at the end of the semester was £19,811.

The output from the mine was well maintained during the half-year, but the tonnage treated was slightly less than that of recent years, in consequence of economy in the use of certain stores, which was thought desirable. The bullion realized was £231,332, compared with £234,285 in the corresponding period of 1915. The yield per ton reached the satisfactory figure of over 49s. ¾d. per ton treated and is the highest recorded since the reopening of the mine. Working costs showed an increase due to the enhanced prices of stores and material brought about by the war.

The usual interim dividend of 9d. per share on the ordinary shares was recommended and approved. This dividend amounted to £20,485. Ten per cent. preference-share dividend for six months ended Nov. 20 and tax amounting to £6487 were also paid, and £20,000 was transferred to capital works accounts.

It was announced at the meeting that the board had decided to take the necessary steps for working the lode below horizon 20. In the last annual report it was estimated that at the end of the present financial year—February, 1917—there would be standing in the mine from horizon 20 upward sufficient ore for 4½ yr. stamping, at the present rate of 16,000 tons a month. The proposed new shaft would open up four more horizons, 21, 22, 23 and 24, each of which, 300 ft. in depth, would last 1½ yr. at the present rate of consumption, assuming the lode retained its present size. This would give a life of 10½ yr. down to horizon 24. There has been progressive increase in the value of the lode in recent years. The question of improved ventilation has been settled after careful inquiry, and a new plant will be ordered.

Superior & Boston Copper Co.

The annual report of the Superior & Boston Copper Co. for the fiscal year ended Sept. 30, 1916, shows balance on hand Oct. 1, 1916, of $176,107, against $29,529 Oct. 1, 1915. This balance is made up as follows: Cash and ore in transit, $176,603; supplies, $15,476; accounts receivable, $1339; against which there are accounts payable of $17,311, leaving a net balance as of Oct. 1, 1916, of $176,107. Receipts for the year were $313,060, made up as follows: From calls, $237,840; interest, $5190; ore sales, $40,500. Expenditures for the year were: For development at mine and expenses Houghton office, $110,970; construction and equipment at mine, $8483; loans paid, $17,500; making a total of $136,953.

The mine produced during the year to Sept. 30, 1916, ores of the value of $207,622, of which lessees shipped $167,121.

During the fiscal year the greater portion of the development work was confined to operations in the upper levels. Practically all of the drifting, crosscutting and raising was done on the 800-ft. level. These workings were all driven in the footwall in order to run vertical raises, as most of the ore is about 70 ft. above the 8th level and the greater portion of ore shipments came from that point. The chief hindrance to mine operation, as well as the source of the largest items of expense, was the handling of the mine water. The shaft sinking progressed satisfactorily, and the shaft bottom is now near the 1400-ft. level.

Jim Butler Tonopah Mining Co.

The annual report of the Jim Butler Tonopah Mining Co. for the fiscal year ended Sept. 30, 1916, shows receipts for the fiscal year on account of shipment of ore and sales of stored silver, $640,000; interest received on deposit, $7313. Disbursements during the fiscal year were: Operation of mine and conduct of business at Tonopah, $274,651; conduct of business at Philadelphia, $9176; income tax, $2856; dividends Nos. 2 and 3, $343,604; leaving a balance on hand Sept. 30, 1916, of $267,724, as against $250,698 Sept. 30, 1915. In addition to this cash, the company had on hand Sept. 30, 1916, silver bullion (at 50c. per oz.) to the amount of $97,495.

The net realization for the period was slightly greater than for the previous fiscal year, making 1916 the most profitable year in the life of the company. This was owing to the high price of silver. The tonnage handled was less, the average metal content per ton in ounces of gold and silver was less, while the combined mining, transportation and milling costs were higher, but a higher average price received for silver and an increased percentage of extraction in the mill, together with a small profit made from a lease operated by the company, overbalanced the unfavorable factors and made possible the greater profit.

The ore reserves as of Sept. 30, 1916, amount to 19,158 tons. The report says: "As of Sept. 30, 1915, the estimated ore reserves of all classes totaled 40,310 tons. During the fiscal year 52,142 tons of crude ore was mined. Comparing the ore extracted during the year plus the ore reserves at the end of the year with the ore reserves at the beginning of the year, it is apparent that some 30,990 tons was added to the tonnage indicated as on Sept. 30, 1915. The Jim Butler property, with its large acreage of virgin, unexplored territory, has been considered to have great posibilities."

The report does not leave a particularly favorable impression, for despite the optimistic way of stating results, the fact remains that the ore in sight is only 19,158 tons, against 40,310 tons a year ago, although during the year development work was "pushed to the allowable limit." And while "geological information of the utmost importance in the consideration of future possibilities" has been brought out, "geological developments during the past year in certain portions of the property have been discouraging."

Hermann A. Keller

Hermann A. Keller was killed by being struck by a locomotive in a mine tunnel at Clifton, Ariz., Feb. 16. He was visiting Clifton on professional business. No further particulars of the accident have yet reached here.

"Hermann," as he was fondly known among the old Leadvillians and the early workers at Butte, was born in Philadelphia, Mar. 23, 1860, the son of Dr. William Keller. He was educated first at the Gymnasium, at Darmstadt, Baden, and next at the University of Pennsylvania, where he was graduated in 1881. Immediately upon his graduation he received an appointment to the instruction staff as assistant in mining and metallurgy. In 1882 he went to Leadville, becoming assayer and chemist for the

HERMANN A. KELLER

Arkansas Valley Smelting Co. In those times the direct road to promotion in a smelting works was through the analytical laboratory, and in course of time the superintendency of his plant came to him. This was in 1886. In 1888 he became metallurgist of the Globe Smelting and Refining Co. at Denver, and in 1889 superintendent of the Philadelphia Smelting Works at Pueblo. From the latter he returned to the Arkansas Valley Smelting Works again as superintendent. In 1891 he was appointed superintendent of the Parrot Smelting Works at Butte, Mont., which position he held until 1896. Leaving the Parrot works, he reconstructed the smeltery of the Mountain Mines at Keswick, Calif., and in 1897 established himself as a consulting engineer in San Francisco.

Up to this time Hermann Keller had been distinctly a smelter, first of silver-lead ores, then of copper ores. He was widely and favorably known as a good superintendent and a metallurgist of skill. He exhibited considerable inventive ability and while at the Parrot works designed the ingenious and efficient mechanical roasting furnace with which his name is associated. This furnace was used extensively at the Parrot works in Butte, and at the Germania works near Salt Lake City. During this period he was a frequent contributor to the *Engineering and Mining Journal* and to the *Transactions* of the American Institute of Mining Engineers; and he collaborated with Dr. Peters in writing the chapter on "Bessemerizing" for "Modern American Copper Smelting."

After the completion of his engagement with the Mountain Copper Co., Mr. Keller became less and less interested in metallurgy and more and more in mining, although metallurgical jobs frequently came to him. Thus we find him about 1899 conducting prolonged experiments with the Ellershausen process at Angoulême in France, but in the main his work as consulting engineer became the examination and development of mines. This work took him to all parts of the world. He was one of the first to go to the Copper River region in Alaska. Another year would find him in Chile. At one time he did extensive work in Germany. There was scarcely a part of the world in which there are mines that he did not visit professionally.

After a few years with his headquarters in San Francisco, Mr. Keller removed to New York, which thenceforward was the place of his office, but there were ever long periods, while he was on his travels, during which his office did not see him.

Hermann Keller was twice married. His second wife, who was Miss Laura Guiteras, survives him, but he left no children. His brother—the popular and lovable "Billy" Keller—also a distinguished mining engineer, died many years ago. One other brother survives.

Hermann Keller was a man of wide acquaintance and many friends, who will miss his genial presence. We do not think he ever had an enemy in the world. He was first a metallurgical engineer and then a mining engineer of marvelous experience and remarkably sound judgment. By his death the profession has suffered a great loss.

John Adams Church

John Adams Church was born Apr. 5, 1843, at Rochester, N. Y. He graduated from the School of Mines, Columbia University, in 1867, as a member of the first class to receive the degree of E. M. from this school. He went to Europe shortly afterward and spent several years in travel, the professional side of which was revealed in his "Notes on a Metallurgical Journey," published in 1873. During this period he took a practical course at Clausthal.

On his return to this country he took over Professor Egleston's courses in mineralogy at the School of Mines during the latter's absence on leave. From 1872 to 1874 he was assistant editor of the *Engineering and Mining Journal*. In 1877, as a member of the United States Geological Survey west of the 100th Meridian, ("Wheeler's Survey"), he made the studies which resulted

in a monograph on the Comstock Lode, published in 1880. In this treatise he advanced the novel and ingenious theory that the heat of the rocks and waters encountered in depth on the Comstock lode is due to the kaolinization of the rocks—a theory which elicited much discussion and was not generally accepted by chemical geologists as a complete and satisfactory explanation. In the light of subsequent publications in the science of economic geology and the formation of ore deposits, this discussion has become an academic one—the heat of the earth's interior being recognized as both the product and the cause of various thermic processes, among which those of metamorphism have their secondary place. Professor Church's paper on the subject in the *Transactions* of the American Institute of Mining Engineers (Vol. VII, pp. 45-76) is very interesting and able. It was controverted with equal ability by George

JOHN ADAMS CHURCH

F. Becker, of King's survey, in Vol. VIII of the same *Transactions*.

From 1878 to 1881 Mr. Church was professor of mining and metallurgy in the State University of Ohio. Besides the paper just mentioned, he made at this period many other contributions to professional literature.

In 1880 he became superintendent of the Tombstone Milling and Mining Co., in Arizona. One of his problems here was to find a basic flux for the lead-silver concentrates from his mill; and this he solved by replacing iron with manganese. For two years he ran his blast furnaces on slags containing about 43% MnO, characterized by great fluidity and low metal losses. These slags have become the classic examples of their types.

In 1886 the Chinese Viceroy, Li Hung Chang, engaged him to introduce American mining in China. Some old silver mines in Mongolia were selected for modern development, and Mr. Church took his family 150 miles north of the Great Chinese Wall, among a people who had never before seen a European. Here he spent nearly three years, reopening the mines, modernizing the practice and erecting a smeltery. Again the problem of basic flux came up, and this time it was solved with crushed magnetite, the only available material. A Chinese belief in dragons forced him to send an extra day's journey for coal; the mines were threatened by a band of robbers, which was finally broken up by cavalry; the labor was utterly ignorant and at times difficult to handle. Nevertheless, at the expiration of his contract, Mr. Church left a producing property, although he foresaw the continued difficulties of modern industry in a land without railroads.

Upon his return to America, in 1890, he established a consulting practice, which he maintained until his death. He was a member of the American Institute of Mining Engineers, which he joined in 1872, and of which he was a manager from 1879 to 1881 and from 1894 to 1896, and a vice-president in 1907 and 1908. He was also a member of the Century Club in New York and was a frequent contributor to technical literature. In 1879 he received the degree of Ph.D. and very recently that of M.Sc., both from his Alma Mater. In 1884 he married Miss Jessie A. Peel, who, with a son, survives him.

Alexander Burrell

Alexander Burrell, general manager of the Furnace Creek Copper Oxide Co. and one of the best-known mining men of Montana, died suddenly at the Agro mine on Feb. 13, 1917. Apparently Mr. Burrell had been enjoying his usual health. The end came suddenly about 10 o'clock in the morning while he was seated in his chair at the mine office. He was a prominent Mason and also belonged to the Ancient Order of United Workmen.

Mr. Burrell was born at Edinburgh, Scotland, Jan. 14, 1851. With his parents he came to Chicago in 1856. The elder Mr. Burrell died soon after his arrival at Chicago. From childhood, Mr. Burrell had to depend upon himself. His opportunities to gain an education in schools were limited, but he was a natural student, and when he had reached man's estate he possessed a liberal education. All his life he read and studied, particularly in the sciences. In addition to the practical side of mining, he had a highly developed scientific knowledge of the business. It was this technical education as well as his ability as an executive that won for him a high place in mining circles in Montana.

Mr. Burrell as a very young man engaged in mining in Illinois. He worked as a miner and later became an operator of a coal property, with fair success. With his brother, he afterward engaged in the manufacturing business in Chicago. Disposing of his interest in Illinois in 1888, he moved to Marysville, Mont., then the principal gold-mining district of the state, and entered the employ of the Montana Co., Ltd., an English concern that owned and developed the famous Drum Lummon mine. He was steadily promoted by this company until he became its general manager, and the

property was operated under his management for many years.

During this period, or a large part of it, Mr. Burrell had his residence at Helena. When the orebodies in the Drum Lummon mine played out, he in some measure retired, although he retained his interest in mining and was sought after in a professional way. He always was interested in politics. He was identified with the Republican party and as a Republican was elected to the legislature from Lewis and Clark County in 1892. He served in that body with much credit. As a member of the house committee on mines and mining some very important legislation was framed by him, and in other ways he rendered distinguished service to the state. He could have been reëlected, it was generally admitted, but he declined to make the race for any office, as his own affairs took up all his time.

From Helena Mr. Burrell removed to Teton County, where he acquired a large and valuable tract of land at Choteau, where he established a pleasant home, known far and wide for its hospitality, and there most of the members of his family reside.

Recently Mr. Burrell was selected as general manager of the Furnace Creek Oxide Copper Mining Co., which in January secured control of the Argo mine, 30 miles from Helena. For several weeks he had been at the property engaged in the work of developing it. He had been given entire charge of the property by the company and associated interests, as he had their complete confidence.

Mr. Burrell married Miss Abbey Kiersted, of Morris, Ill., Apr. 8, 1879. To them there were born the following children: George L., Alexander A., Grace, Sidney H., John A., William D., Roger A., Howard and Nan K. All are living except William D. Burrell, who died in California in 1906.

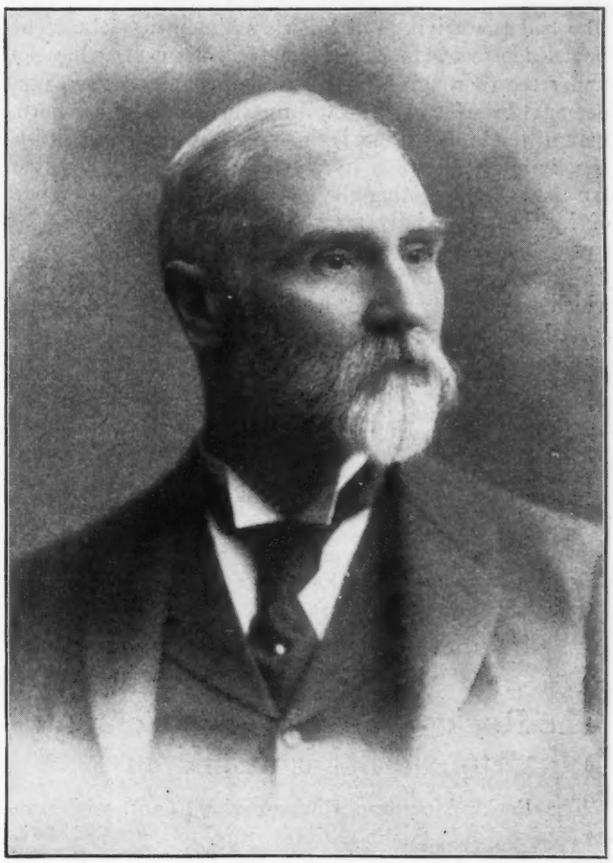
August Raht

August Raht, whose death occurred at San Francisco, Dec. 25, 1916, was born Feb. 25, 1843, at Dillenburg, Duchy of Nassau, where his father was president of the Court of Appeals. After passing through the gymnasium, he studied mining and metallurgy, graduating from the Polytechnic Institute at Hesse-Cassel in 1863, and continued his studies at Freiberg.

He came to the United States about 1867 and engaged in professional work with the Ducktown Smelting and Reduction Co. at Ducktown, Tenn. He was connected with metallurgical work in the United States more or less continuously except for some professional trips to Italy and to Africa, being absent about two years. On his return to the United States, he went West and became connected with various metallurgical operations at Pueblo, Colo., New Mexico and Utah, at first with the Mingo plant and later, in 1883, building the Horn Silver plant. About 1887 he went to Wickes, Mont., and later to Helena, Mont., building the plant of the Helena & Livingston Reduction Co., at East Helena which afterward was consolidated with the Great Falls plant, built by Anton Eilers, forming the United Smelting and Refining Co., of which Mr. Raht was manager.

About 1889 Meyer Guggenheim & Sons built and put into operation the Philadelphia Smelting Works at Pueblo, Colo., their chief purpose being to smelt more advantageously than the terms offered by other smelters, the zinky lead sulphide ore of the A. Y. & Minnie mine at Leadville, in which the Guggenheims were interested. The Philadelphia plant was put in operation with metallurgical and commercial results that looked disastrous and would indeed probably have wrecked a concern less strong financially. After a series of vicissitudes the Guggenheims made up their minds that what they needed was the best metallurgical advice and direction that possibly could be obtained, and seeking such assistance, they engaged Mr. Raht, who took up the work at Pueblo about the latter part of 1891 or early in 1892. He soon succeeded in putting the enterprise upon its feet and thereby convinced the Guggenheims of the correctness of the principle that the best technical knowledge—no matter what salary or fee may be required to get it—is the cheapest thing in the operation of such a business.

Mr. Raht continued with the Guggenheims in an operating and consulting capacity for a number of years while



AUGUST RAHT

they were enlarging and developing their metallurgical plants, acting for them in Colorado, Mexico, Perth Amboy, N. J., and other places. He visited Australia for the London Exploration Co. about 1899 and, on returning to the United States, was again connected with the Guggenheim interests, especially the American Smelting and Refining Co., until his retirement from active work about 1910.

August Raht was actively and prominently connected with the development of the smelting industry in the United States during its most important period, both in copper and lead, although more prominently in the latter. He originated many improvements in details of operation and was one of the first of the Western metallurgists to

recognize the importance of being able to treat complex sulphide ores, his work of this kind at the Philadelphia smeltery at Pueblo, Colo., being very largely the cause of its success. This plant was one of the pioneers in providing itself with equipment for treating lead sulphide ores on a large scale. Mr. Raht was one of the first to recognize the possibility and benefit of low fuel in the blast-furnace operations connected with lead smelting. In the early stage of lead smelting, and before the present practice of converting mattes became common, he worked up such copper byproducts at the Philadelphia plant into blister copper. During the greater part of his later technical career he successfully devoted himself to solving the new problems which were arising with the evolution of lead smelting.

In addition to being a man of unusual technical ability, he had a fund of general knowledge, particularly with regard to all branches of natural history, which was a constant source of wonderment and admiration to those who had the privilege of knowing him intimately. This knowledge seems to have come from his early education under the thorough German system, coupled with a deep personal love for everything in nature. He was a sportsman of the highest type, both as regards hunting and fishing, indulging in this purely for the sport rather than for the sake of getting the game; and in the latter part of his life, especially after his retirement from active work, his principal relaxation was, while living on the California coast, to indulge in fishing of the various kinds which the locality afforded. With all his varied knowledge, he was so exceedingly modest in using it that it took a rather intimate acquaintance to find it out.

To the younger metallurgists whom he met during the development of this science in Colorado and elsewhere, Mr. Raht was of the greatest help. They all soon learned that they could freely ask his advice and assistance with the assurance of receiving it in the most unreserved and helpful way.

Mr. Raht leaves two daughters; Mrs. L. G. Eakins, wife of general manager L. G. Eakins, of the American Smelting and Refining Co. in Denver, and Mrs. Stewart A. Marsh, of Grand Rapids, Mich.

The Rocky Mountain Club Continues to Aid Belgian Children

The Rocky Mountain Club of New York, which recently decided to devote all its energies to the relief of the hungry children of Belgium, according to an announcement in the New York *Herald,* Mar. 4, 1917, while its new clubhouse project was laid aside, has been perfecting its organization for making a nation-wide canvass for funds. Theodore Roosevelt has consented to serve as honorary chairman of the General Committee which has been formed. This is the first war-relief effort with which Mr. Roosevelt has been connected. He consented to serve and not only lend his name but his personal efforts, for two reasons: In the first place, as a man closely identified with the Far West, the Rocky Mountain Club idea of waking up the country appealed to him; and, in the second place, the appeal made by the condition of the children of Belgium struck him with irresistible force. He has always regarded Belgium as the blackest spot in the present war.

The active chairman of the General Committee of the Rocky Mountain Club is Edward H. Clark, long and prominently identified with the West, and the treasurer is William B Thompson, originally a Montana man. The other members of the committee are:

Kurnal R. Babbitt, C. W. Barron, Bernard M. Baruch, Thomas Burke, Benjamin F. Bush, Edgar E. Calvin, Thomas L. Chadbourne, Jr.; William H. Crocker, J. S. Cullinan, Maurice S. Dean, James S. Douglas, Walter Douglas, Robert H. Driscoll, Coleman du Pont, Albert J. Earling. Stanley A. Easton, L. O. Evans, Sam D. Goza, Daniel Guggenheim, John Hays Hammond, Rusell Hawkins, Charles Hayden, Hale Holden, Norman B. Holter, Willard S. Hopewell, J. Guthrie Hopkins, Samuel Insull, Daniel C. Jackling, C. B. Lakenan, Adolph Lewisohn, Clarence B. Little, O. J. McConnell, N. Bruce MacKelvie, James MacNaughton, Charles M. MacNeill, E. P. Mathewson, Charles W. Merrill, Eugene Meyer, Jr.; Charles E. Mills, John C. Mitchell, Seeley W. Mudd, William A. Nichols, Spencer Penrose, Lawrence C. Phipps, William C. Potter, P. J. Quealy, Charles F. Rand, L. D. Ricketts, John D. Ryan, Eugene P. Shove, W. Hinckle Smith, Thomas B. Stearns, Benjamin B. Thayer, J. E. Thompson, Chester Thorne, George Turner, Thomas J. Walsh, Bulkeley Wells, William Wallace, Jr., and Charles W. Whitley.

The club has committees for "team work" in this city. The Brokers' Committee is at work and the Newspaper Committee, composed of editors who are members of the club, is headed by William E. Hazen.

While the city membership of the club is working here, unceasing attention is being paid to the Western country, of which it has been said that no sentiment exists for assisting the sufferers from the war.

An appeal is also being made to the miners in these Western States. The miners of South Africa are giving 10% of their earnings to the Belgians, and the miners of America are to have an opportunity of saying how much they will give.

The club is trying to raise $1,000,000 a month, which is urgently needed to give the children of Belgium one meal a day to keep them from starvation.

Chronology of Mining for Month of February, 1917

Feb. 2—Great Britain put restrictions on dealings in pig lead and products thereof—Suit filed against Tennessee Copper Co. and National Surety Co. by Russian government for $1,140,000 advanced on trinitrotoluol purchase.

Feb. 13—Price of silver reached 79c. per oz., highest price since June, 1893—Smeltery of Mason Valley Mines Co. at Thompson, Nev., resumed operations.

Feb. 15—Cerro de Pasco Copper Corporation stock listed on New York Stock Exchange.

Feb. 19—Smelting resumed in Mexico by American Smelting and Refining Co. at Monterey, after an idleness of about one year due to hostile conditions.

Feb. 25—Snowslide at Federal Mining and Smelting Co.'s North Star mine, 12 miles northeast of Hailey, Idaho, struck compressor house and bunkhouse, killing 16 men.

Freight Congestion

The freight congestion due to car shortage has been somewhat ameliorated. From Nov. 1, 1916, to Jan. 1, 1917, the car shortage was reduced 50%, attributed, it is claimed, more than anything else to the coöperative efforts of the Interstate Commerce Commission, shippers and the railroads. Recent conditions, which have caused such trouble, are attributed to three causes: (1) The lack of rolling stock by the railroads; (2) much of the freight arriving in New York, particularly food staples and materials being held unloaded purposely so that financial advantage may be gained from the constantly advancing prices; (3) freight intended for foreign shipment being tied up for lack of bottoms.

The effects of the German submarine policy are now being felt and it is expected in shipping circles now that Washington has failed to find some means of overcoming the menace immediately that the congestion will be aggravated. So far as the shortage of ships is concerned, no help can be expected, as almost every shipyard in the world is working at present to its utmost capacity, and it takes so long to construct vessels.

As to the second cause, it would seem that so many investigations into the high cost of living would trail this charge to its source if true, and thereupon prescribe a remedy. As to the first charge the railroads say it is not true. While one of the most important members of the Produce Exchange in discussing the car shortage has said that "if things go on as they are, there will be a shortage of practically all kinds of foodstuffs in the East, and the poor middleman and speculator will have the blame put on his shoulders, whereas it is nothing more than a matter of equipment and inability of the railroads to bring goods from the West to the East."

The American Railway Association has issued a circular which states that in the 10-year period ended Dec. 31, 1916, the railroads of the United States added to their equipment 678,000 cars and that in that period on an average of 92 days out of every 100 the railroads of the country provided more cars than the shippers called for to carry the traffic of the country. At times an extraordinary percentage of cars was idle for the lack of freight. Figures compiled by this same source show there have been car shortages in the last 10 years only in 1907, in the winter of 1912 and 1913 and in 1916, and that during that 10 years the amount of car idleness due to lack of freight to be hauled was 13½ times the amount of car shortage. Alfred H. Smith, purchasing agent for the New York Central R.R., in writing on this subject under date of Jan. 24, 1917, said: "Our foreign trade has increased from $4,000,000,000 at the beginning of the war to $8,000,000,000 at the present time, and domestic trade has increased from about $30,000,000,000 to about $46,000,000,000, the domestic trade showing an increase of nearly 50% and the foreign trade nearly 100%. In addition to this enormous foreign movement to and from tidewater, there has been set up a greater internal industrial situation in manufacture and commerce, to provide these supplies which, in many cases, have to be handled half a dozen times from one plant to another in process of manufacturing and finishing. This condition was precipitated almost immediately, and the railroads within a few months were called upon to perform in many instances a service 40% in excess of the preceding year."

Testifying before the Interstate Commerce Commission in Washington, December last, W. W. Atterbury, president of the American Railway Association, said that a certain railroad in Philadelphia was unloading 1400 cars which necessitated a "pot" of about 3800 or 3900 cars, that is, its yard took care of that number of cars and had them available to throw into the industry, in order that those 1400 cars should be unloaded. The following year this company increased its yard facilities and in 1916 made another increase, so that it now has a holding capacity of nearly 7000 cars, and yet the unloading ability of the shippers has increased only from 1400 to 1800 cars. The effect of all this is to clear the running track, but it does not release equipment, and while the railroads can increase their facilities for holding loaded cars at terminals, they claim that they cannot force unloading; that has got to be done by the consignee himself. Embargoes are being placed throughout the West on various materials and at the time of writing the embargo on zinc sheets from Illinois is absolute.

A duty rests upon the consignee to unload his shipment immediately on arrival, and if this is done it will be solely up to the railroad to shoulder responsibility for car shortage and freight congestion.

Probably too little weight has been given to severe winter-weather conditions as effecting congestion of freight and shipments. Lightering in New York and New England, by which copper, lead and zinc are handled more perhaps than some other commodities, has been stopped at times by actual freeze-up of the channels.

Under date of Mar. 1, 1917, the Pennsylvania railroad issued a statement announcing material progress in expediting the movement of freight over its system, between the Middle West and Eastern points, effected through the work of the newly established Pennsylvania System Joint Embargo Committee, which has its headquarters at Pittsburgh.

This committee was created to devise means for more satisfactorily handling freight affected by embargoes, between the lines East and West, by making modifications of embargoes where transportation conditions and the ability of consignees to remove freight from the cars promptly upon arrival permit such exceptions to be made. This makes more effective the object sought in handling freight under embargoes, which is to prevent terminal congestion by separating the freight that will be held in cars at destination from that which will be taken off the railroad's hands without delay.

As a result of the committee's efforts there have been moved in one week, through the Pittsburgh and Buffalo gateways, more than 3100 carloads of freight of all kinds, which were under embargo and could not have been handled with equal promptness, if at all, except by special arrangement effected by the committee. Of this freight approximately 2000 cars were eastbound and 1100 cars westbound. At the close of the week arrangements were pending for the movement of 4100 additional cars of embargoed freight.

During the period in question the committee has had presented to it for consideration nearly 1500 separate applications for individual shipments under special modifications of the embargoes. It has been possible thus far to grant about half of these applications. All shippers seeking special permits for the movement of embargoed freight have been placed upon an equal footing.

New Smelting Schedule at Tacoma

SEATTLE CORRESPONDENCE

Because of the number of small copper properties that sprung into existence during 1916, as well as the greatly increased tonnage of ore produced by its regular shippers, the Tacoma Smelting Co. last spring found ore was offered greatly in excess of its smelting and converting capacity, which ore it would be necessary to put on the stockpile, during the summer months at least.

In order to encourage the new shippers, as well as to protect itself against a sudden drop in the market, the company offered them a new schedule of treatment, of which the principal feature was that in the case of ore that it was necessary to stock, a preliminary settlement would be made on the copper at the rate of 14c. per lb., and on the silver at 55c. per oz. Final settlement was to be made, 90 days after the ore was reclaimed from the stockpile, on *Engineering and Mining Journal* quotations at the end of that time.

This schedule remained in force for the rest of the year. Meantime, the addition of a large reverberatory furnace, together with greatly increased converter capacity and the partial completion of a new refinery, enabled the smelting company to reclaim a great part of the ore stocked in the early summer months and to smelt approximately 500 tons per day over previous capacity. A considerable decrease of shipments took place during the winter months.

These conditions have led to the announcement of new schedules by the company. Instead of not making final settlement for the ore until 90 days after the ore is actually smelted, as outlined in the circular letter of May 25, 1916, the company will now make prompt settlement for the ore on the current quotations, provided the shipper is willing to allow an adequate margin sufficient to offset the risk involved in carrying copper in stock at present prices. A sudden drop in the price of copper would wipe out all the smelting company's profit, and therefore in order to cover this emergency the company has provided in Schedule *A*, reproduced below, a clause which provides that when copper is over 14c. per lb., the smelting company is to absorb one-quarter of the excess price of copper over 14c. per lb. Schedule *B* provides for making an advance on the copper and final settlement on the 90th day after actual date of arrival of the ore at the plant, thus making a definite settlement date. In making shipments, the miners are requested to notify the smelting company under which schedule they elect to have their ore treated. The schedules follow:

SCHEDULE A

Gold—Pay for 95% of the gold at $20 per oz. No pay for gold under 0.03 oz. per ton.

Silver—Pay for 95% of the silver contents at New York quotation on date of arrival of the ore at the smelting company's plant. No pay for silver unless 1 oz. per ton or over.

Copper—Pay for 100% of the copper on the wet assay, less a deduction of 1.3 units, at 3c. less than the price for copper as follows: When copper is quoted at or below 14c. per lb., the price basis is to be the "Engineering and Mining Journal," of New York, wire-bar quotation on the date of arrival of the ore at the smelting company's plant. When the quotation is more than 14c. per lb., the price will be 14c. per lb. plus 75% of the excess over 14c. per lb. For example, if the copper quotation is 30c. per lb., the price basis will be 14c. plus 75% of 16c., equals 12c., or a total of 26c. per lb. will be the price for copper.

Treatment Rate—To be $1.50 per ton, f.o.b. smelting company's plant.

Penalties—Zinc limit 8%; 30c. a unit will be charged for any excess, fractions in proportion. Arsenic and antimony combined, 3% allowed free; 50c. a unit will be charged for any excess, fractions in proportion.

SCHEDULE B

Gold—Pay for 95% of the gold at $20 per oz. No pay for gold under 0.03 oz. per ton.

Silver—Pay for 95% of the silver contents at New York quotation. No pay for silver unless 1 oz. per ton or over.

Copper—Pay for 100% of the copper on the wet assay, less a deduction of 1.3 units and less a deduction of 3c. per lb.

Settlement—Preliminary settlement will be made immediately upon the sampling and assaying of the ore on a basis of 14-c. copper, 55-c. silver and $1.50 treatment. Final settlement will be made 90 days after date of the arrival of the ore at the smelting company's plant. Delivery of the ore to be f.o.b. smelting company's plant.

The copper quotation to be used in final settlement will be the average wire-bar quotation for the six days published in the "Engineering and Mining Journal," of New York, of the calendar week previous to the 90th day after arrival of the ore at the smelting company's plant, and it is provided that if the final quotation is in excess of 18c. per lb., the treatment rate is to $2.50 per ton.

The silver quotation to be used in final settlement will be the New York quotation on the 90th day after arrival of the ore at the smelting company's plant. In the event, however, that should this particular date be a legal holiday or one upon which no quotation is issued, the next succeeding quotation will be used.

Penalties—Zinc limit, 8% allowed free; 30c. a unit will be charged for any excess, fractions in proportions. Arsenic and antimony combined, 3% allowed free; 50c. a unit will be charged for any excess, fractions in proportions.

General Clauses—The rates herewith apply on any size lot down to five tons. On anything under five tons we add to these rates a flat sampling charge on each lot of $10.

In the event that should the quotation date fall on a legal holiday or one upon which no quotation is issued, the next succeeding quotations will be used in settlement.

All schedules on ore not under contract for a definite period of time are subject to change without notice. However, should a shipment be en route at a time when a change in the schedule is made, that one shipment will be settled for on the rates as herein quoted.

Treatment rates apply on the ore delivered at our plant.

On the above schedules where the word "ton" is used, it is understood to be a ton of 2000 lb. avoirdupois; where the word "ounce" is used, as referring to gold and silver, it is understood to mean the troy ounce, and where the word "unit" is used, it is understood to mean a unit of 1%, or 20 lb. avoirdupois.

In the case of umpires the following rule will be observed: The result obtained by the umpire shall be accepted by both parties provided the result obtained is between the results obtained by both contestants. If the result obtained by the umpire is above or below the results obtained by both contestants, the assay of the contestant nearest the assay of the umpire shall be accepted in settlement and the party whose results are farthest from the umpire's result shall pay for the cost of the umpire.

Ore Dilution in Stoping

In its usual excellent annual report, just issued for 1916, the Hollinger Consolidated Gold Mines, Ltd., Porcupine, Ont., states that in estimating the ore reserve of course actual measurements of ore in place are taken. When the ore is mined, however, it is not possible to prevent a certain amount of waste rock from being broken and becoming intermingled with the ore. This dilution with waste has the effect of lowering the value per ton of the mixture, although it increases the number of tons. The experience of this company after five years of operation shows that there is a dilution in its case of approximately 10%, and hence the present estimate of 3,938,540 tons of ore valued at $8.68 per ton will, when mined and milled, probably yield approximately 4,300,000 tons averaging about $7.75 per ton.

Editorials

The Metal Markets

Conditions in the metal markets are very complex. We can see what they are, but the confusion makes forecasting difficult. What seemed certain about the beginning of January was upset by the unforeseen political and industrial events of February.

In copper the governing condition is the check to production owing to labor difficulties in January, delay in bringing in raw material in February and the strain on plant generally. Demand keeps up, and the only hope for early relief is increased production.

Probably 99% of the expected production of this country up to July 1 is sold to ultimate consumers, including in this category the allied governments. Therefore, the only chances for business for delivery from March to July are:

1. Resale of copper by consumers who have overbought. In the latter half of December and the first half of January such reselling and readjusting was going on, but now it is probably completed.

2. The possibility that some of the producers will make a little larger production than they were justified in estimating and will be able to put that metal on the market. The chances for this seem now rather slim, for owing to the refinery and transportation troubles, producers have probably oversold rather than undersold.

3. The possibility of the release for sale in this country of some of the tonnage contracted for by the Allies.

During the last fortnight business in copper for delivery in July, in the third quarter, and even in the fourth quarter, has been developing, but has not yet attained any large proportions.

We may add to the three possibilities mentioned, one other: The tightness in the copper situation—and the same is true of lead—has frightened consumers, each of whom is looking out for himself and himself only, and there is some probability that certain of these, in order to be on the safe side, have contracted for more copper than they are really going to need. Under certain conditions, which need not be pointed out, such surplus copper (if it exists) may be released later on.

The tension in lead has been due mainly to the lock-up on the railways. Advantage has been taken of this by some small interests to jack up prices. The largest producers have opposed that, regarding it as unfair to strangle consumers (who are taking more than 50% of the country's output on average prices) by marking up prices to correspond with relatively small transactions made under stress. Unfortunately, the big producers sold themselves out, so that they lost control of the situation. If the large consumers had been willing to go easy in their March specifications, so as to give the producer some lead, conditions would have been ameliorated, but apparently everybody wanted for himself all that he could get, although perhaps it might not really be needed. It has been, therefore, the consumers' own fault to a large extent that they have had to pay such high prices. But perhaps it does not matter greatly, for if the market should get thoroughly aflame, the time will come when some consumers will be tempted to resell, and the outcome will be about the same anyhow.

In spite of the acuteness of the moment, we think we can discern some moderating factors coming into play, and an easing of the tension may be expected before the end of March. The American Smelting and Refining Co. has resumed smelting at Monterey, and the new lead from that source should be ready for this market late in March. Some of the Hercules ore is going to Trail, which sooner or later will ease the Canadian demand for pig lead. There have already been indications that there are certain consumers who are thinking of reselling some lead. But of course the factor that is going to fix things is release of the lead on the railways, and already that seems to be trickling through a little more freely.

Zinc is in fairly liberal supply, although production has possibly been reduced to some extent. With blende assaying 60% zinc quoted at $90 per 2000 lb. in the Joplin market, and spelter at 10¼c., St. Louis, the smelting margin is practically back to normal; and indeed it may be less than normal, considering the increased cost of smelting. The margin on Western ores also has shrunk. Ore supply seems to be less liberal, which may be partly due to freight delays in this country and partly to inability to bring in any more Australian ore. Anyway, there is no longer the great profit in smelting that there was in 1915-16, and this is a reason why some producers are not driving so hard, are taking advantage of the opportunity to make necessary repairs, etc. Those who have spelter to sell are holding it with the idea that the United States Government may be a buyer.

Military Mapping by Geological Survey

At one of the military lectures before the members of the various national engineering societies in New York last year, a high-ranking officer in the Engineer Corps of the Army made the startling statement that there was not in existence a set of proper military maps from which a military officer could lay out proper maneuvers for the defense of New York City, not to mention other important centers throughout the country. There is now hope that this may in time be remedied. A distinct division has been created by the United States Geological Survey, known as the Division of Military Surveys, to coöperate with the War Department for the production of such maps as will meet the requirements of the Army. It is recognized that the topographical maps of the Geological Survey are invaluable for military purposes so far as they go, but they are topographical maps for engineering purposes and omit most, if not all, of the important features of military importance, which are necessary in the tactical handling of troops. Inasmuch, however, as nothing has as yet been done, further than to make a start, the amount

of work facing this division is tremendous and all but impossible of accomplishment within the period which it may be assumed will intervene before the need becomes imperative.

Thirty-six states have state geologists, and these officials, with their state organizations, could be coördinated with the War Department in the matter of military mapping, to the great advantage of the latter. The state geologists, more than any other individuals, know in detail of such important features in their state, knowledge of which is absolutely necessary to military operation in the territory, as potable and impotable water supply, swampy and unsanitary locations, conditions of ground making for excellence of camp sites, localities supplying the three fundamental requisites of a good camp site—wood, water and grass—and infinite other details. If all the state geologists were to work in harmony with the department and collect, tabulate and map these data in times of peace, when it can be done with a certain amount of composure, it would be ready to hand when needed and would obviate the necessity of sending out military reconnaissance parties to make hurried road sketches, some of them from the saddle, with the unavoidable inaccuracies due to the haste with which they are made. Rock features and rock formations are known to these state geologists, which the reconnaissance parties of the army would be at loss to see or comprehend, which features might be of inestimable value to military commanders in the way of trenching, mining, tunneling, location of siege guns, transfer of troops through rough country, etc.

It has become a platitude nowadays that war is dependent on the opposing engineering talent and capacities, but these are not confined to the munition factory. Mining engineers abroad are in the forefront of distinguished service, and the only documents of interest now being published by some of the English mining and metallurgical institutions are lists of the members in the service and their whereabouts and conditions. Work for our own mining engineers is to be found in many ways and coöperating with state geologists in complete mapping of the states is one that will be of inestimable value in case of war and of great, perhaps of equal, value during the pursuits of peace.

Russian Mining

We do not often give so much space to a single article as is allowed for that on Russian mining in this issue. It seemed to us, however, that circumstances afforded a good excuse to break a rule. The value of the article, both for immediate reading and for later reference, is increased by putting it in one issue, while another justification is to be found in the great interest in Russian mining that is now being exhibited in this country.

Not long ago an advertisement for a mine manager wanted for a foreign country was published in the department of "Positions Vacant" of our advertising pages. An extraordinary number of replies was received. This surprised us greatly, knowing the unusual activity in mining prevailing in this country and the relatively small number of mining men who are unemployed. We sought elucidation from the advertiser, asking him how he accounted for it. "Oh, they want to go to Russia," said he. "But there was no mention of Russia in the advertisement." "True enough," he replied, "but they surmised Russia and therefore the volume of the applications."

Such great interest is being exhibited not only by mining engineers, but also by American capitalists. Without any doubt, American investment in Russia is going to be large and advantageous, both to the Russians and to ourselves. The publication of such an authoritative article as we are able to offer this week is, therefore, unusually timely and will constitute a highly valuable reference.

Spelter Statistics

In connection with the revised and detailed statistics of the zinc industry that it has been our custom to publish annually, we are this year conducting an investigation of the consumption of spelter in 1916, which will be reported according to the main purposes—galvanizing, brass making, sheet zinc, etc. We used to collect and report such statistics, but abandoned them some six or seven years ago. The renewal of this investigation for 1916 is particularly important inasmuch as there have been such phenomenal changes in the nature of the consumption since the beginning of the war. Previous to 1914 galvanizing was the principal consumption of zinc; since 1915 it has been brass. The establishment of reliable data respecting this industrial revolution will be of great value not only in estimating commercial conditions at the present time, but also for the student of economics in the future.

We are glad to be able to say that consumers are coöperating generally in this investigation by communicating promptly and specifically the data requested respecting their individual business. Producers, as usual, are responding freely as to their production, ore receipts, etc. The results of the investigation will be communicated to all producers and consumers and will be published in the *Journal* for the benefit of all readers as soon as possible.

Flotation Theory

The underlying reasons for the phenomena of which flotation is a demonstration still continue to puzzle students of the question. Flotation operators know the manifestations of forces involved and, in a general way, how to enlist their aid, but they do not know enough to foretell definitely the action that will result from the application of any particular set of conditions. It may be considered certain that until the basic theory is discovered, the whole truth about flotation application will not be known. What is necessary is to find out why oil adheres preferably to minerals rather than gangues, if it does, and what qualities in oils or in the gangues promote or interfere with this tendency. The fact that the introduction of the various substances into the solution or mill water, such as acid, copper sulphate, etc., may have a decided effect upon recoveries, leads operators to ask what these effects are, why they so act, and how they can be controlled.

The evident desirability of knowing these facts is promoting a careful study of them in a good many laboratories connected with mining industries. That the whole truth will be worked out there, however, is by no means certain. It seems probable that no one scientist will be able to arrive at all of the truth, since it will probably involve chemistry, physical chemistry and physics.

BY THE WAY

The Hollinger report for 1916 includes the following appreciative statement: "The work of the year has been constantly under the shadow of the war, not only in difficulties arising therefrom, but also in losses of a personal nature. Last year we reported that two of our young men had fallen in France; during the year four more have been killed and a number of others seriously wounded."

⁂

Regardless of the merits of the question, it is apparent that the smelting subsidiary of the Coniagas Mines, Ltd., is being stung, judging from a paragraph in their annual report, just published, which says: "During the year some of the residents within a few miles of your Reduction company have entered suit against that company for damages for the alleged destruction of bees during the years subsequent to 1908, and the decision of the court is expected about the new year."

⁂

The Assembly Chamber in the State Capitol at Albany, N. Y., was the scene on Feb. 28, of a very unusual function, perhaps unparalleled in the history of the state. The governor, the state officers, the Senate, the Assembly, and minor officials, dropped their routine affairs for an hour and listened to Herbert C. Hoover, who addressed a joint session of both houses of the legislature on the subject of Belgian relief. There was little oratory about Mr. Hoover. He contented himself with a quiet presentation of the case for Belgium. After his address he was the guest of honor at a luncheon given by Col. William Gorham Rice. The luncheon consisted of an exact duplicate, quantity, quality, and composition—the soup and bread—that make up the standard Belgian ration.

⁂

Frank M. Leland, for many years of Coram, Calif., who resigned recently as general manager of the Balaklala and Trinity Copper companies says that he quit because the job "did not furnish enough to do." Mr. Leland will be remembered by old-time San Diegans as the man who installed the first electric-power plant in San Diego in August, 1887. The plant was situated between San Diego and Old Town. "I systematized myself out of a good position," said Mr. Leland. "I had everything running so smoothly and each department was handling its work so well that there was nothing for a manager to do except to open his personal mail. I thought it was time to quit." Mr. Leland made a mistake in quitting, and so did his companies in letting him go. A manager who has nothing to do but read his mail is the right kind of a manager.

⁂

The rubber-stamp stage has been reached in stock speculation. Brokers have been sadly overworked for the last six months and may have to take a vacation unless the strain is removed. One of the newer firms, to facilitate speculation, has now adopted the rubber stamp as an auxiliary. It sends out a post card stating. "We call your attention to the new situation in ——— ——— Co. Recent months show a decided change in earning power, and surplus available for dividends." The circular goes on to say that the market position of these issues is likely to be strongly affected in the near future. Whenever speculation becomes inactive, the broker may send out a series to stimulate interest among prospective investors. Of course the same facts apply to all companies, and the rubber stamp reduces typewriting. The value of a rubber-stamp invitation to invest seems doubtful. Possibly the brokers now feel that the public will gulp at a piece of red flannel or any old bait.

⁂

Don't buy a stock whereof the price is advertised to advance on a certain day and minute. It is easier to buy than it is to sell.

⁂

Do not be hoggish. It is better to be a year too early than a minute too late.

⁂

When your morning paper contains ads. of four or five brokers urging the purchase of something like Dakota Pet, ask yourself why they should be spending good money for space. They are not philanthropists.

⁂

Report of Copper Production

This table is compiled from reports received from the respective companies (except in the cases noted by asterisk as estimated), together with the reports of the United States Department of Commerce as to imported material, and in the main represents the crude-copper content of blister copper, in pounds.

	January	February
Alaska shipments	2,516,372	.....
Arizona:		
Arizona Copper	4,100,000	.....
Cons. Arizona	.....	.....
Inspiration	11,600,000	10,250,000
Miami	5,020,370	4,210,780
Old Dominion	3,000,000	.....
Ray	7,767,663	.....
Shannon	759,000	888,000
Other Arizona	28,696,785	.....
California:		
Mammoth	2,200,000	2,200,000
Michigan:		
Calumet & Hecla	14,103,126	.....
Other Lake Superior*	9,500,000	.....
Montana:		
Anaconda	25,250,000	25,000,000
East Butte	1,479,520	1,460,440
Nevada:		
Mason Valley	†	.....
Nevada Cons	6,279,432	.....
New Mexico:		
Chino	6,452,154	.....
Utah:		
Utah Copper	13,913,811	.....
Eastern Smelters*	2,670,370	.....
Total reported	148,308,603	
Others, estimated	26,850,000	.....
Total United States	175,158,603	
Imports in ore	.....	.....
Imports in blister copper	.....	.....
Grand total	.....	
British Columbia:		
B. C. Copper	331,667	.....
Granby Cons	.....	.....
Mexico:		
Boleo	1,983,080	.....
Cananea	5,700,000	.....
Other Foreign:		
Braden	4,798,000	3,450,000
Cerro de Pasco	6,172,000	.....
Chile	7,756,000	.....
Cape Copper	398,720	.....
Kyshtim	1,131,200	.....
Spassky	.....	.....
Katanga	3,297,280	5,152,000

*Estimated. †Operation just started.

Personals

Bradley Stoughton is at New Orleans.

C. A. Gibbons, Jr., is with the Andes Development Co.

Algernon Del Mar is manager for the Dewey Mines Co., Siskiyou County, Calif.

Howland Bancroft has returned to his Denver office after an extended absence in South America.

H. R. Van Wagenen is en route to Chile on professional business. He will be away until about July 1.

Martin Schwerin is at Pearce, Ariz., in connection with mine examination and development work in Arizona and New Mexico.

Nelson Dickerman has gone to Guatemala on professional business. He expects to return to San Francisco about the first of May.

D. H. Browne who has been confined to his bed a week with the grippe is improving and hopes to be at his office before the end of another week.

Kirby Thomas will spend several weeks in Brazil concluding an examination of the Sumidouro gold mine, in the Ouro Preto district, Minas Geraes, for a New York syndicate which has a contract for the property.

Dr. G. F. Matthews, of St. John, N. B., has been awarded the Murchison Medal and Check by the Royal Geological Society of England for valuable services in connection with geological research in New Brunswick.

T. Hart Given, president Farmers' Deposit National Bank, Pittsburgh, has been elected a director of the Crucible Steel Company of America to fill the vacancy in the board caused by the death of C. C. Ramsey.

B. E. V. Luty, of Pittsburgh, Penn., has celebrated his 25th anniversary in iron-trade journalism. For many years he has been a trusted and faithful contributor to technical and trade journals in the iron and steel fields.

Prof. James F. Kemp is back in New York, very much improved in health. Indeed, he is doing a little work, but he is still obliged to take things easy. His recovery and return is the subject of great rejoicing among his friends.

W. W. Hall, for some years district sales manager of the Republic Iron and Steel Co. in the Pittsburgh district, has resigned, and after about April 1 he will be connected with the Columbia Steel and Shafting Co., Carnegie, Penn.

J. E. Spurr, geologist for the Tonopah Mining Co., and E. E. Carpenter, designer of the Eden mill, are in Nicaragua to be present at the starting of milling operations of the Eden Mining Co., the leading subsidiary of the Tonopah Mining Co. in Nicaragua.

William H. Gessman, blast-furnace superintendent at the Gary plant of the United States Steel Corporation, has been appointed general superintendent of the open-hearth plant of the Brier Hill Steel Co., Youngstown, succeeding William H. Warren, who is now general manager.

Pierce Barker, chief chemist at the Washoe Reduction Works of the Anaconda Copper Mining Co., has been promoted to the position of superintendent of the blast furnaces, succeeding H. W. Aldrich, who resigned to accept a position in British Columbia. Mr. Barker is succeeded by J. A. Root.

Dr. L. D. Ricketts was taken ill with pleurisy during the recent meeting of the American Institute of Mining Engineers and remained "on the job" when he ought to have stayed at home. Since then he has been quite ill, but is now recovering. However, his projected trip to Chile will be delayed considerably.

Stanley E. Bates, formerly editor and manager of "The Contractor," has become associated with the Lee Leader and Body Co., 2343 South LaSalle St., Chicago. As a civil engineer, Mr. Bates has made a special study of haulage problems, particularly those of the contractor, and is author of many articles on the subject.

P. N. Nissen, inventor of the Nissen stamp, is a Major in the Royal Engineers, British Army, and has invented, as a result of his estimation of the necessities, a steel shelter, or hut, which serves as a home for 24 soldiers in the field. The shelter is entirely of steel, is sectional, and can be set up in a few hours. It is provided with a stove for heating.

Wm. J. Uren has been appointed manager of the Seneca mine, Michigan. Mr. Uren has the technical training of the Michigan College of Mines, combined with an inherited tendency to copper mining (his father, the late Capt. Richard Uren, having been a mining "agent" as managers then were called, for numerous Michigan mines) and years of practical training in various mining and milling capacities. Mr. Uren constructed the original Trimountain stamp mill. Later he was assistant to William E. Parnall when that well-known mining man succeeded his father in charge of the Bigelow mines of the Lake district. When Judge Haire became manager for the Bigelow interests Mr. Uren continued as actively in charge of the mines.

Obituary

Frederick Rowland Hazard, president Solvay Process Co., and a director in many large industrial corporations, died at Syracuse, Feb. 27. He was born at Peacedale, R. I., in 1858, and was graduated from Brown University in 1881.

Clarence R. Brown, manager of the Buchanan Foundry Co., Lebanon, Penn., died Feb. 20 after a week's illness from pneumonia, aged 31 years. He went to Lebanon from Philadelphia two years ago to succeed his brother, T. Harold Brown, in the management of the foundry in which the Brown family holds a controlling interest.

Theodore Newton Barnsdall, aged 66, pioneer driller and oil producer, with various interests in more than a dozen states, and in the Dominion of Canada, and known throughout the country as one of the foremost men in the oil industry, died on Feb. 27 in his home, 1025 North Negley Ave., Pittsburgh, Penn. He had been ill for a week. On Feb. 19 he experienced an attack of grip and on Feb. 24 he suffered a paralytic stroke. Mr. Barnsdall was born in Titusville, Penn., the son of William Barnsdall and Fidelia Ann Goodrich, pioneer residents there. His father drilled the first oil well after the famous Drake well, and was owner of the first oil refinery in the country. It was located at Titusville.

Societies

Portland Cement Association will hold its spring convention at the Palace Hotel, San Francisco, Apr. 16-18, inclusive. This will be the first time in the history of the association that any of its meetings have been held west of Chicago. A special train has been arranged for the going trip from Chicago to San Francisco via the Northwestern, Union Pacific and Southern Pacific route. This train will leave Chicago at 8 p.m., central time, Friday, Apr. 13, and arrive at San Francisco at 9 a.m., Monday, Apr. 16. At the conclusion of the committee and business sessions of the association it is planned that members attending will go in a body to Del Monte, Calif., and spend Apr. 19 and 20 there in an outing.

Southwestern Society of Engineers held their second session at the Hotel Sheldon, El Paso, Texas, on Mar. 8, 9, 10. Papers and discussions were presented on "Engineering Education, Its Purposes and Necessity," by Dean Butler, University of Arizona; "Some Lessons Taught the Mining Industry of the Southwest by Present Activities and Prices," by Gerald Sherman, of Phelps-Dodge & Co. "Modern Highways and the Dividends They Pay," by J. L. Campbell, El Paso & Southwestern R.R.; "Engineering in National Defense," by Lieut.-Col. Walker, U. S. Army. This was followed by the first annual banquet on Saturday night. This society was formed and had its first meeting in October, 1916, through the efforts of the faculty of the New Mexico College of Agriculture and Mechanic Arts, to bring into closer touch, professionally and socially, the engineers in western Texas, Arizona and New Mexico.

Stevens Institute of Technology, through its alumni, has been actively engaged in measures for military and industrial preparedness, so that the present emergency has not taken them by surprise. Acting through their committee on military and naval affairs, there is now being compiled a classified list of Stevens men willing and ready to serve in such branches of the Army or Navy as their specialized education and experience will prove of most value in the Government service. Many Stevens men have already been commissioned in the Officers' Reserve Corps. Some are officers in the Regular Army, the Navy and the National Guard, while others are doing special work in ordnance and in naval engineering. This enrollment is being carried on under the auspices of an advisory committee, consisting of: Alex. C. Humphreys, president, Stevens Institute of Technology; John W. Lieb, vice-president, New York Edison Co.; Robert M. Dixon, president, Safety Car Heating and Lighting Co.; Anson W. Burchard, vice-president, General Electric Co.; William D. Hoxie, vice-president, Babcock & Wilcox Co.; Newcomb Carlton, president, Western Union Telegraph Co.; William A. Field, general manager, United Alloy Steel Corporation; Charles H. McCullough, Jr., vice-president, Lackawanna Steel Co.

Trade Catalogs

Dewco Ball Mills. The Denver Engineering Works Co., Denver, Colo. Bulletin No. 1077. Pp. 16; 8½x10½ in.; illustrated.

Thew Shovels, Steam, Electric, Gasoline. Thew Automatic Shovel Co., Lorain, Ohio. Catalog No. 9. Pp. 32; 6x9 in.; illustrated.

Industrial News

Nordberg Manufacturing Co., of Milwaukee, Wis., recently shipped through Mitsui & Co. a large electric hoist for installation at the Ashio copper mines of Furukawa & Co., Tokyo, Japan.

Stroh Steel-Hardening Process Co., Pittsburgh, Penn., is preparing for widening its activities and has appointed F. L. Mark, Western sales manager with headquarters at 728 Monadnock block, Chicago.

De Laval Steam Turbine Co., Trenton, N. J., manufacturers of steam turbines and helical reduction gears for all classes of service, including ship propulsion and marine work, centrifugal pumps, centrifugal compressors and similar apparatus, announces the opening of a district sales office in the Smith Building, Seattle, Wash., in charge of Mr. William Pullen.

Newport Turpentine and Rosin Co., at its new plant at Pensacola, Fla., uses the Newport process, which is the extraction of turpentine, rosin and pine oil by a steam and solvent method, from finely shredded resinous pine. The raw material enters at the west end of the plant and travels east, the products and byproducts being delivered at the extreme east end of the plant, to the storage and shipping stations. The products are marketed by the General Naval Stores Co., New York.

Redwood Pipe—Redwood Manufacturers Co., San Francisco, Calif., report the following installations of Remco Redwood pipe in mining and metallurgical plants; 24,000 ft., 48 in. Morococha Mining Co., Peru; 3700 ft., 18 in. Braden Copper Co., Chile; 30,000 ft., 52 in. for a power line for the Homestake Mining Co., Lead, S. D.; 4600 ft., 42 in. to Utah Copper Co., Arthur Plant; 10,000 ft., 8 in., 12 in., 16 in., Garfield Water Co., Garfield, Utah; 700 ft., 6 in. copper wound for acid solution transmission, Burro Mt. Copper Co., Tyronne, N. M.; 900 ft., 12 in. for the Minerals Products Co.'s chemical plant at Marysvale, Utah.

Wellman-Seaver-Morgan Co., Cleveland Ohio, held a meeting of its Board of Directors on Feb. 26, at which Edwin S. Church was elected president to succeed Willard N. Sawyer, who tendered his resignation because of poor health. Mr. Sawyer will not engage actively in business for the present, hoping that by giving up business cares he will recover his health, which has not been good since he suffered an attack of typhoid fever two years ago. Mr. Church is well known in the industrial field. He was for some time president of the McIntosh & Seymour Corporation, Auburn, N. Y., and he has recently been engaged in some special work in connection with the export trade. W. P. Cowell was reëlected secretary and treasurer. S. T. Wellman, chairman of the board, and S. H. Pitkin, first vice-president, will continue in those positions until their successors are elected.

New Patents

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

Alloy—Metallic Compound. Herbert B. Coho, Mount Vernon, N. Y., assignor to United Lead Co. (U. S. Nos. 1,217,710; 1,217,711; Feb. 27, 1917.)

Blast Furnace—Charging Device. John Nicholas Reese, Youngstown, Ohio. (U. S. No. 1,217,219; Feb. 27, 1917.)

Blast Furnace—Open Hearth Furnace. Nelson Thomas and Anson W. Allen, Birmingham, Ala. (U. S. No. 1,217,367; Feb. 27, 1917.)

Blast Furnace—Apparatus for the Detection of Leakages in the Water-Jackets of Blast Furnaces. Enrique Retuerto y Rizo, Portugalete, Spain. (U. S. No. 1,217,346; Feb. 27, 1917.)

Cast Iron—Composition of Cast Iron. Joseph E. Johnson, Jr., New York, N. Y. (U. S. Nos. 1,217,184, 1,217,185; Feb. 27, 1917.)

Crusher—Breaker and Drier. Henry G. Schwarz, Denver, Colo. (U. S. No. 1,217,351; Feb. 27, 1917.)

Concentration—Process of Concentrating Oxide Ores of Copper. Rudolf Gahl, Miami, Ariz. (U. S. No. 1,217,437; Feb. 27, 1917.)

Crusher—Ring Roll Mill. Edgar B. Symons, Milwaukee, Wis. (U. S. No. 1,217,525; Feb. 27, 1917.)

Drills—Steel Retainer for Hammer Drills. Russell H. Wilhelm, Easton, Penn., assignor to Ingersoll-Rand Co., Jersey City, N. J. (U. S. No. 1,217,378; Feb. 27, 1917.)

Drilling Machine. Frank Marovitch, Nelson, British Columbia, Canada. (U. S. No. 1,217,617; Feb. 27, 1917.)

Electric Furnace. Carl A. Pfanstiehl, Waukegan, Ill., assignor to Pfanstiehl Co. (U. S. No. 1,217,497; Feb. 27, 1917.)

Editorial Correspondence

SAN FRANCISCO—Feb. 27

Yuba Consolidated Gold Fields, Ltd., operating the largest fleet of placer-gold dredges in one field in the world, is preparing for the 17th dredge while the 16th is nearing completion. Designs for Yuba No. 17 are in course of preparation by the engineering department of the Yuba Construction Co. at Marysville. Yuba No. 16 will be put in commission early in March and the construction of No. 17 will begin in July. The new dredge will be equipped with 18-cu.ft. buckets and one tailing stacker; it is to be operated in a section of the Hammonton field that does not require the disposition of the tailing on both banks of the river as in the case of the No. 16 dredge, which is provided with two tailing stackers. The installation of six all-steel dredges in this field in the last three years and preparation for the seventh and the recent installation of a steel hull dredge in the same district by the Pacific Gold Dredging Co. is fairly good evidence that the dredging industry in Yuba Basin district is not waning.

Legislation Affecting Mining includes 20 bills so far introduced in the present legislature of California. Most of these concern labor and none of them has been referred to the committees on mines and mining. In the legislature of 1915 a good deal of legislation detrimental to the mining industry was essayed, but vigorous opposition of mining men seeking to protect the industry from bad laws succeeded in preventing the passage of the bills. The California Metal Producers Association will no doubt be called upon for the same sort of protection of the industry in the last half of the present legislature. There are two bills which are particularly offensive and equally useless so far as benefitting the labor element is concerned. One is the semi-monthly payday; the other a bill which provides that it shall be unlawful to operate mines (and other specific industries) on Sunday. Miners, generally, have no use for two paydays a month and most of them do not desire it. The law would be a serious inconvenience to the operators and result in no advantage to the workmen. The proposed law prohibiting operation of mines and other industries on Sunday reads like a joke, but its enforcement would be a disaster. The bill provides for permitting work essential to the protection of the mines, but as the enforcement of the law is in the hands of the labor commissioner the prospect for the mines affected by the enforcement would not be at all encouraging. There are several industries exempt, according to the provisions of the bill, as "works of necessity." It is refreshing to notice that two of such exemptions are saloons and ice-cream parlors. And these exemptions are what make the bill read like a joke; but its proponents are serious about it, and that is why it behooves mining men to kill the measure in committee, if possible. Some mining men are inclined to believe that the proposed law is so preposterous that it will stand no chance of enactment. But it is just as well to be on guard. Fool laws are sometimes slipped through.

BUTTE—Mar. 1

Gould Tax Bill, originally proposing a license tax of 0.75% on the net income of all corporations that do an annual business of $10,000 or more, was amended to increase the tax to 1% and was at last passed by both houses of the legislature in session at Helena. While by no means satisfactory, the bill will be accepted by the interests affected, because it is less burdensome and less unfair than other measures which have been urged and because it is probably the most satisfactory bill that could be enacted at this session. At best it will be only a temporary makeshift to provide revenue for carrying on the business of the government for the next two years, pending adjustment by a permanent tax commission that will collect full data on which to base a just and fair taxation of all industries of the state. To those who had favored a special taxation of the mining industry, the amended Gould bill will no doubt prove a disappointment. As it now stands, the mining industry alone will contribute about $1,200,000 a year to the state's revenue, which will be ample to take care of the deficit that confronts the state.

Anaconda's Accident Record in 1916 shows the excellent results of the campaign carried forward by the Bureau of Safety, under the direction of John L. Boardman. In spite of the 21 deaths at the Pensylvania mine fire in February, 1916, the average for the year was only 0.12 per 10,000 shifts as compared with 0.10 in 1915. The average number of serious accidents per 10,000 shifts in 1915 was 1.32; last year it was 0.79. The total of fatal and serious accidents in 1915 was 1.42 per 10,000 shifts and in 1916 was 0.91—a reduction of 35.9%. The principal causes of accidents were: Falling ground and rocks, 34.3%; ore cars and trains, 10.1%; handling timber and tools, 26.5%; overcome by gas, 0.3%; falling material, tools and timber, 3.4%. The comparative tabulations show that there has been a noticeable decrease in the serious-accident rate in 1916. Falling ground and rocks, which caused 0.585 accidents per 10,000 shifts in 1915, caused only 0.339 per 10,000 shifts in 1916, a decrease of 42%. The safety-first work is being pushed steadily and conditions are becoming more and more safe every month. The men are exercising greater care and the management is highly pleased with the progress already made. Practically every mine of the 28 operated by the Anaconda company in the Butte district has its own safety-first team and some of the larger ones have second teams organized. The contests between these teams have aroused a healthy rivalry between the mines and this in turn has served to awaken an interest among hundreds of miners who were inclined to be careless before this movement started. The records at the Washoe smeltery and at the Great Falls reduction works also show a big reduction in the percentage of accidents in the last two years.

Another Tuolumne Find, which is looked upon as highly important, is reported by the company from the Main Range property. On the 700-ft. level of the Spread Delight vein, a northwest fissure was cut, opening 4 ft. of silver ore. It runs 82 oz. in silver and 1.9% copper. It is thought that this northwest vein is the same fissure that was cut about three weeks ago by the crosscut being driven south from the Sinbad shaft for the purpose of reaching the Torrid and Rory O'Moore. There it showed a width of 6 ft.; 2 ft. was of heavy pyritic material with a knife-blade stringer of copper ore. The present silver-ore development is at a point on strike of this vein about 200 ft. farther north and west. Where the ore was encountered was at the intersection of the Spread Delight vein and the northwester. The Spread Delight vein itself shows the effect of the juncture. The stope near the crossing shows 8 ft. of clean ore which assays 58 oz. of silver and 5% copper. The ore in the Spread Delight is of a different character from that in the northwester. In the latter fissure, the ore filling plainly is of a distinctly silver character; pink manganese is in evidence and the ore is of the same general appearance as that of the Alice, and here and there ruby silver is to be seen. During the month of February there was shipped from the Main Range mine of the Tuolumne company approximately 1000 tons of ore. The old Tuolumne mine during the month of February produced about 3500 tons or a good increase over the previous month. January smelter returns on Main Range ore amounted to $4821 and on Tuolumne ores $30,089. February returns will show a big increase.

DENVER—Feb. 28

Custom Flotation Mill at Ouray is to be established in the remodeled Foerster mill, which is expected to be ready for commercial operation about Apr. 1. Dr. Edward C. Weatherly has been working on this project for two years and has finally succeeded in financing it. David Foerster will be manager of the plant.

Two Colorado Dredging Projects are under consideration, according to the newspapers of Breckenridge and Golden, which are each to have a new gold dredge this year. The Lambing placer, 2 miles below Breckenridge along the Blue River, has been systematically drilled under the direction of Walter J. Radford with results that have warranted the placing of an order for a modern dredge; this ground produced much nugget gold from pioneer bedrock shafts. James Myers and Harry Wright are back of the Golden project which contemplates dredging from the Avenue bridge, in the City of Golden, up Clear Creek Valley to the mouth of the cañon; test shafts are being sunk.

Central City's New Charter removes an interesting anachronism from this early Gilpin County settlement's official documents. History relates that the first lode-mining claim in the Rockies was taken up between the present towns of Black Hawk and Central City by a man named Gregory from Georgia. That Gilpin County must have been settled principally by Southerners appears evident from an interesting bit of business that has recently engaged some attention in the state legislature. It seems that when Central City was organized in 1859, one provision of the incorporation excluded negroes from voting. The subsequent passage of the Fourteenth Amendment to our Federal Constitution automatically nullified this provision but it has remained unchanged in the city's charter to date. The Jenkins Bill, now before the legislature, establishes a new charter for this city that made Colorado the Eldorado of the late 50's.

SALT LAKE CITY—Mar. 1

Gross and Net Earnings of Utah Mines for 1916 are being filed with the state board of equalization for purposes of taxation. Some of these figures for well-known mines may be of interest. Horn Silver Mines Co., at Frisco, in Beaver County, reports: Gross proceeds, $325,978; net proceeds, $11,236. Salt Lake Copper Co. (Copper Mountain mine), $111,462 and $30,708. Independent Coal and Coke Co., $462,898; $174,619. Pleasant Valley Coal Co., Winterquarters, $340,-188; $60,272; Castlegate, $686,875; $161,901; Clear Creek, $409,373; $96,968; Utah mine, $30,-513; $9293. Utah Fuel Co., Sunnyside, $1,473,-392; $438,133. United States Fuel Co., Panther, $70,939; $11,694; Mohrland, $350,581; (deficit) $18,761; Hiawatha, $312,408; $78,869; Black Hawk, $404,205; $130,395. Centennial-Eureka, $1,176,152; $406,982; Bullion Beck and Champion, $112,859; $11,576. Victoria Consolidated, $117,221; $36,314. Dragon Consolidated, $261,-992; $37,688. Chief Consolidated, $2,635,061; $569,240; Eagle & Blue Bell, $530,850; $128,719; May Day, $72,809; $19,267; South Hecla, $188,-904; $30,161; United States Smelting (United States mine), $2,343,632; $507,546; Niagara, $34,142; $20,558. Bingham Mines Co. (Dalton & Lark mine), $439,103; $127,718. Tintic Mining and Development, $1,038,341; $285,630. Utah Metal and Tunnel, $748,581; $297,716; Ophir Hill, $788,684; $479,016; Bingham-New Haven, $750,686; $318,342; Utah Apex, $2,652,323; $784,202. Gilson Asphaltum Co. (Bonanza mine, Uinta County), $50,816; $13,317; (Rainbow mine) $319,145; $73,538. American Asphaltum Association (Temple and Country Boy mines) $333,-497; $26,867.

PHOENIX, ARIZ.—Mar. 2

Proposed State Smeltery Killed by the Foster Bill being placed at the foot of the long committee-of-the-whole calendar. It would have been killed if passed to the senate, where the mines committee already had reported a substitute. It is an exact copy of the smeltery bill, save that instead, provision is made for a state sampling and ore-buying works, with appropriation of $100,000, in the place of the $750,000 carried by the other bill. The same provisions are made for an operating committe of three, at $10 a day, and for repayment of the sum expended on the works through a sinking fund of half of the 10% profit stipulated above the operating cost. There is little prospect, however, of its passage. The senate committee on mines also has unfavorably reported the two-man-drill bill, which had been passed in the house; it was considered especially burdensome upon small mine owners. From Miami the legislature has received a communication, signed by the officers of the miners' union, asking provision of funds by the sale of state bonds for use in public works in the event of a depression in the copper market and consequent closing of mines; it is related that the high wages of the copper camps and cold weather in the North have brought to Arizona camps a large overplus of labor, especially of mechanics. Senator Devine, of Pinal County, has offered a bill designed to correct the common practice of relocating or contesting ownership of mining claims about the time the owner is known to have a chance for selling.

DULUTH, MINN.—Mar. 6

Two Great Northern Ore Leases are reported in a story printed by the "St. Paul Dispatch" on Mar. 5. The leases are reported sold to the Inland Steel Co. and to the Jones & Laughlin Co. of Pittsburgh, and are to run until the mines are exhausted. No confirmation obtainable at Great Northern Ore Properties office, in the absence of Carmi Thompson, manager.

HOUGHTON, MICH.—Mar. 3

The Tramming Problem in the Michigan copper mines has been acute during the last season, and with the continued shortage of labor will be just as difficult a problem next spring. Already a number of the companies have taken steps to introduce or extend mechanical-haulage installations. The Calumet & Hecla company is meeting with success with its installation of a storage-battery locomotive on the 16th level at No. 15 shaft on the Osceola lode. It is likely that more of the same type will be installed at an early date. Two of company's engineers have been sent East on a tour of inspection of this type of locomotives among the

coal mines, and to the plants both of manufacturers of locomotives and of storage batteries. As soon as the trolley system at the Allouez has been installed and given a fair test, a good comparison can be made as to which would be the best system to establish on a large scale. This, of course, depends on the character of the place where the locomotive is to be installed, as there are some workings where it would be almost impossible to install a trolley system. Extensive trials will be given both types before any definite action is taken. Calumet & Hecla has now 20 of the new Peerless drills, the Ingersoll-Rand No. 128; this drill has been tested extensively and is said to be a faster cutter than the Leyner-Ingersoll. The C. & H. company is now shipping from 10,500 to 10,800 tons daily to the mills, having less trouble than other properties in handling loaded rock trains, because of the downgrade run to the mills. The company will soon commence building the new large extension planned for its leaching plant, which will double the present capacity.

JOPLIN, MO.—Mar. 3

New Field seems about to be developed 4 mi. southwest of Joplin, at a point where the geologists gave no hope for any ore to be found. The Grand Falls chart, which marks the lowest sheet-ground formation in this district, outcrops at this point, but at a depth of 150 ft. good ore has been encountered by a company prospecting on the Renzenhausen farm. The cuttings indicate lead- and iron-free ore, which is reached after going through 150 ft. of solid rock.

Raising $12,000 Fund has been undertaken for sanitation and safety work in the Joplin district. If this sum is raised by the mine operators, Dr. W. A. Lynott of U. S. Bureau of Mines, who now is working here, likely will be retained for two years. The sum mentioned will be to pay his salary for this term and also provide running expenses for a free dispensary and clinic established in Webb City a year ago. The plan is to get forty operators to give $300 each, as all the money is to be in the bank before the plan is decided upon.

TORONTO—Mar. 3

Subsidized Smeltery on Pacific Coast was foreshadowed in the address of Lieutenant-Governor Barnard at the opening of the British Columbia Legislature on Mar. 1. In outlining the policy of the government he referred to possibility of the establishment of a smeltery on the Pacific Coast with the assistance of the government and assured prospectors and the owners of small mining properties of the continuance of government aid.

The Nickel Question is still being discussed in the Ontario legislature. On Mar. 1, considerable surprise was caused in political circles by the statement of Hon. I. B. Lucas, provincial attorney general, in the course of a hot debate on the nickel question, that at the outset of the war the International Nickel Co. offered to turn over to the Canadian government the sole control of their nickel output. This announcement has considerably weakened the force of the attacks on the government policy, which derived their principal effectiveness from the popular impression that the company was to some extent under German control or influence.

WASHINGTON—Mar. 6

Mobilization of Mineral Resources has been occupying an important portion of the time of the directors of the Geological Survey and of the Bureau of Mines since the severance of diplomatic relations with Germany. Every effort is being made to be in a position to serve the War Department effectively and efficiently in case the nation should be called upon for a great military effort.

Seattle Experiment Station of the U. S. Bureau of Mines is preparing for active work. Metal-mining problems comprise two of the three main objects aimed at. Dorsey A. Lyon, in announcing the program to be followed at the station, gives first place to research to determine how far it may be profitable and feasible to use electricity in recovering metals from their ores by electrothermic and electrolytic processes. Treatment problems arising in the Northwest and in Alaska will constitute another main division of the work. Mr. Lyon specifies, however, in his report to Washington that only such problems will be considered as may differ from those being studied at other stations. The third subdivision of the work provides for studies of coal in the Northwest.

Potash Explorations in Texas are reaching an an exceedingly interesting stage. If Fate will just be kind, one of the greatest scientific victories of a century is within the grasp of the Geological Survey. The drill in the prospect well, near Cliffside in the Texas Panhandle, is reaching the salt strata in which soluable potassium salts are expected to be found. Rapid progress is being made in the drilling which is being conducted under scientific control. A chemist is stationed at the well and every boring is examined. While there is geologic evidence that Cliffside is the center of maximum evaporation in the great inland sea which covered a large area of the Southwest, it is recognized that some of the essential minor conditions necessary to the depositing of potash may not have existed. While it is known that the greater part of this sea was taken up by evaporation, it is not known that it evaporated to the last dregs. It is possible that drainage may have been established. Since potassium salts are so highly soluble, they would have been among the last ingredients of the water to be deposited. If drainage took place while there still was a considerable quantity of water in the sea, it is probable that no potash was deposited. Even if evaporation was complete, the potash naturally would be deposited in the final pools. While admitting the possibilities of failure, there is a strong hope existing among geologists of the Survey that this first well will disclose the presence of potash. With the drill already in ground that may contain this much-needed mineral, each letter from Cliffside is awaited with interest.

MELBOURNE—Feb. 2

Principal Copper Mines of New South Wales are the Great Cobar, Mouramba, C. S. A., Mt. Hope and Abercrombie. The Great Cobar has been at work during the whole year and is producing about 650 tons of ore per day; the output for 1916 will be about 2600 tons of copper. The Mouramba company at Nymagee has taken over the old N. G. E. smeltery at Eskbank and is remodeling and extending the plant. The mine is handicapped by transportation difficulties, being situated 45 mi. from the railway. The question of railway communication is being considered by the Government. The C. S. A. mine is being reopened and a smelting campaign is about to be initiated. Reporting on the question of providing railway facilities for this property a government engineer recently estimated that 150,000 tons of secondarily enriched ores averaging 7% copper are available for smelting. The Mt. Hope mine has been reported on by the government geologist also with a view to the provision of transport facilities. It is situated 11 mi. from the main line which is being constructed to Broken Hill via Condobolin. Pending the construction of this spur line, leaching operations on the old dumps are being carried out with satisfactory results. These tailings are estimated at about 30,000 tons averaging 3% copper. The Abercrombie is a new London company formed to take over the Lloyd copper mine at Burraga, which has been idle since July, 1914. The ore reserves at June 30, 1913, were given as 116,400 tons averaging 4.4% copper.

The Mining News

ALASKA

ALASKA-PITTSBURGH GOLD MINING (Bettles)—Mill planned for Daley-Bennett property on Bettles, Bay, Prince William Sound. B. C. Wiltse, president, now at head office, 215 Fifth Ave., Pittsburgh, Penn., making arrangements for coming season's operations.

ARIZONA

Cochise County

WILLIE ROSE (Bowie)—From No. 1 shaft, at 188-ft. level, drifting toward No. 2 shaft to encounter orebody 225 ft. deeper than exposed in latter shaft.

CASEY GOLD RIDGE (Willcox)—This mine, near Dos Cabezas, acquired by H. C. Kimball. About 2300 ft. of workings; both free-milling and base gold-silver ores developed. Mill contemplated.

COCHISE HEAD MINING CO. (Bowie)—Developing this group of 10 claims in Wood Cañon, southeast of Bowie. Copper sulphides encountered in 250-ft. zone between granite and limestone; considered extension of Willie Rose orebody. J. W. Sterling in charge.

COPPER QUEEN (Bisbee)—Breaking of main shaft of hoist at Sacramento shaft interrupted production for several days. Most of company's ore is regularly hoisted through the Sacramento. Repair of broken hoist shaft, which is 28 ft. long by about 15 in. diameter, was accomplished in a few days by bringing in a Thermit repair outfit.

Gila County

INSPIRATION (Miami)—February copper production 10,250,000 lb.; in January it was 11,600,000 lb.

Greenlee County

SHANNON (Clifton)—Copper production in February was 888,000 lb.

Mohave County

BIG JIM (Oatman)—Station cut at 600 level; crosscutting toward the vein.

NORTH STAR (Oatman)—Unwatering the 435-ft. incline, preparatory to resumption of drifting easterly on 400-ft. level.

NELLIE (Oatman)—Crosscutting in big vein at 385-ft. level has proceeded 25 ft.; three shifts sinking shaft to 500 level.

OATMAN CRESCENT (Oatman)—Crosscut tunnel in 800 ft.; drifting on Crescent 8-ft. vein toward the andesite; now in latite.

RED LION MINING CO. (Oatman)—Machinery ordered for sinking shaft on this property adjoining the Tom Reed; about 700 ft. west of latter's Gray Eagle shaft.

ARIZONA BUTTE MINES CO. (Kingman)—Recently shipped car of rich lead ore from drift at 2300-ft. point in adit. Three shifts to be put on at mill. H. M. Crowther, manager.

Santa Cruz County

MONTANA MINES CO. (Ruby)—Extensive development being carried out; the double-compartment shaft is being sunk to 700 ft. The 150-ton mill, designed by Bradley, Bruff & Labarthe, of San Francisco, is under construction. Caterpillar trucks hauling freight from Amadoville but Silva station will be used later. E. L. S. Wrampelmeier, manager.

Yuma County

JUNIATA (Parker)—Shaft to be sunk on this gold-copper group of 11 claims adjoining the Empire mine. H. B. Ailman, superintendent.

CALIFORNIA

Amador County

PLYMOUTH CONSOLIDATED (Plymouth)—Report of Supt. James F. Parks, for January shows: 11,000 tons milled, yielding $61,750; working expense $30,077; development $9695; surplus $21,978.

SOUTH KEYSTONE (Sutter Creek)—Good headway being made unwatering old North Star shaft. Explorations just made on 600 level show south crosscut caved at 300-ft. point from shaft. Mine equipped with good surface plant, adequate for development contemplated. Charles H. Colpe, general manager.

Butte County

KELLY (Magalia)—Reported bonded to Salt Lake men and reopening begun by company known as Utah Gold Reef. Mill contemplated.

GOLD BANK (Forebestown)—Operating under lease, with 10 stamps dropping on $8 ore; remaining 10 stamps will be in commission in March. E. I. West and J. Godfrey, leasers.

Calaveras County

ROUGH DIAMOND (Angels Camp)—Horse whim installed and shaft will be unwatered to develop gravel at depth of 57 ft. on the bedrock.

SAFE DEPOSIT (Mokelumne Hill)—Installation of pipe and hydraulic elevator nearly completed; cleaning and widening Mokelumne Canal from which will be taken 1000 in. of water.

NAPOLEON (Milton)—Reported that this copper mine, first producer in California, has been reopened and ores are to be treated by flotation. Dr. E. Coughanour and C. E. Olson are owners. Mine first opened in the 60's and produced rich ore that was shipped to Wales. Closed down and filled with water from 1866 to 1900. Later taken over by the Peyton Chemical Co. and has since been idle a number of years. Situated 9 mi. southwest of Copperopolis and 13 mi. southeast of Milton.

Colusa County

ELGIN QUICKSILVER (Williams)—This old mine near Wilbur Springs being reopened.

Eldorado County

LEMON (Placerville)—Another strike of high-grade ore reported; third paystreak said to have been disclosed under operation of the Hollywood Mining Co. Property developed by 400-ft. tunnel

BEEBE (Georgetown)—Unwatering completed. A 24-in. wooden pipe line, 1700 ft. long, has been installed, connected to the main ditch. Expect to be ready for development work by March. A. E. Gregory, manager.

Inyo County

LAST CHANCE (Bishop)—New property recently developed by Cooper Shapley, who is superintending development for Round Valley Tungsten Co. A 125-ton tungsten mill being designed by Harold C. Miller. Sampling plant will be installed for custom ores. Large tonnage medium-grade scheelite opened. Crosscutting from tunnel at depth of 70 ft. showed vein about 55 ft. wide. Length of the oreshoot being determined by drifting. Electric power will be supplied by Southern Sierras Power Co., which will extend its line 2 mi. north from Tungsten. Associated with the tungsten is 0.7% Cu, and $1.10 in gold and silver.

Nevada County

MAJOR (Nevada City)—This drift mine on Cement Hill will be reopened by J. E. Proctor. Installation of stamp mill contemplated. Shaft is 146 ft. deep and about 600 ft. of drifting has been done on the channel. J. M. Proctor will be manager.

NEW ENGLAND (Grass Valley)—Hoisting and pumping plant to be installed; old inclined shaft to be unwatered and crosscut run from bottom or 900-ft. level to tap Mohegan vein. Both properties will be worked through this shaft. J. C. Campbell is manager.

UNION Hill (Grass Valley)—Auxiliary steam pumping plant installed to prevent flooding of lower workings in case of stopping of electric pumps. Sinking shaft steadily; drifting on orebody. Company also developing South Idaho and other properties. Errol MacBoyle, manager.

OMEGA (Washington)—Raising this dam in Scotchman Creek, near Washington, has been completed. Original dam built, under supervision of the débris commission, several years ago to hold tailings from Omega hydraulic mine, and was filled. In order to resume hydraulic mining the dam was raised. It is provided with concrete key and 43 layers of wire baskets filled with rocks. Mine operated by Harker & Larsen.

Placer County

GRASS VALLEY MINING CO. (Dutch Flat)—Has taken over Wisconsin and Michigan gravel properties. Formerly produced rich gravel; the 1200-ft. tunnel will be extended.

LIME KILN (Auburn)—Development of chrome ore in progress; now hauled to New Castle for $2 per ton, when shipped by rail; 400 tons shipped.

San Diego County

SACRAMENTO MINING CO. (Sacramento)—Permitted to issue 64,000 shares to Bour Mining Co. for option to purchase molybdenum property in San Diego County, and 11,033 shares to William Bowden and associates for money advanced and to sell 25,000 shares at $1 for installing additional equipment and development.

Tuolumne County

EAGLE SHAWMUT (Jacksonville)—Optioned by Tonopah Belmont Development Co.; property includes the mines, mill sites, 100-stamp mill and large surface plant. First installment of purchase price paid. Property operated for years by the Rosenfelds of San Francisco. Louis Rosenfeld, the president, recently died.

COLORADO

Clear Creek County

NEWTON MILL (Idaho Springs)—Additional flotation machines installed.

ROCKFORD (Idaho Springs)—Development will soon be resumed by North American Smelter and Mines Co.

FRANKLIN (Idaho Springs)—Development by Peterson & Co., lessees, has opened payable ore. Jones & Co. leasing on lower levels.

ST. GEORGE (Georgetown)—Being developed under management of Charles Fulton. New compressor being installed.

TOGO AND DRUID (Idaho Springs)—Being developed by G. E. Collins. Electric hoist is being installed and winze will be sunk on the vein.

UNCAS CHIEF MINING AND MILLING CO. (Idaho Springs)—New incorporation to acquire and operate mining properties in Clear Creek County.

FRENCH FLAG (Idaho Springs)—Shaft will be sunk an additional 100 ft. and 300-ft. level will be advanced westward to prospect Silver Age oreshoot. Additions to mining equipment will include air compressor and machine drills. C. S. Ripley, manager.

Custer County

BEAUTY BELLE (Westcliffe)—Lessees opening good-grade lead ore on property near Querida.

BEN EATON (Westcliffe)—Shaft sinking under way near Querida by lessees of Denver.

PRINCESS ANNIE (Westcliffe)—This mine, 12 mi. southwest, in Sangre de Cristo range, being developed by shaft and tunnel work. Silver-copper ore opened and shipping will begin soon. Mineralization in quartz-filled fissures in granite.

Eagle County

BLACK IRON GROUP SALE by American Zinc Co. to Empire Zinc Co. reported to have been completed in Denver recently. Group consists of 30 claims on Battle Mountain and covers about one-third of limestone belt of district. Cheesman estate, owner of ground, and American Zinc Co. holds lease and bond secured two years ago. Black Iron, it is stated, has been producing 300 to 350 tons zinc ore daily for past two years. Empire Zinc Co. now holds practically entire limestone belt of district.

Gilpin County

TWO-FORTY (Central City)—Being worked by lessees. Mine unwatered and repaired. Stoping gold ore.

ANNEX MINING AND MILLING (Central City)—Long-time lease secured by this company on Saratoga mine and dumps. The 300,000-ton dumps will be treated in company's 10-stamp mill.

Morgan County

DRILLING FOR OIL near Brush will begin soon. All machinery except boilers on ground, drillers also on hand. Town of Padrone has sprung up in consequence of oil boom.

Park County

MAGNOLIA (Alma)—Operations suspended until severe winter weather is over.

IN WESTON PASS SECTION, there is prospect of a mining revival in the spring. The Cincinnati mine has opened a large shoot of shipping-grade lead ore in its tunnel level. Ore being stored at mine until roads are open.

Summit County

JESSIE (Breckenridge)—Development progressing steadily; much low-grade ore blocked out. Ore now being tested by flotation process.

HOWE (Breckenridge)—This group in upper Blue River section taken over by Denver men; operations will start after spring breakup.

ROYAL TIGER (Breckenridge)—Work on this property on Swan River will be resumed. Mine opened by 1000-ft. tunnel; tonnage of gold-silver-lead-zinc ore blocked.

GIBSON HILL MINING AND MILLING (Breckenridge)—Developments encouraging; some lead-zinc ore being shipped and milling ore being placed on dumps until amount justifies mill.

WELLINGTON MINES CO. (Breckenridge)—The Wellington Mines Co. of Arizona, with capitalization of $10,000,000, has been dissolved, and The Wellington Mines Co., a Colorado corporation, with capitalization of $1,000,000, formed. Shareholders in the Arizona corporation will receive a "pro rata" distribution of stock. New arrangement will lessen taxes and simplify conduct of company business.

FLORIDA

Polk County

AMERICAN CYANAMID CO. (Brewster, Fla., and 200 Fifth Ave., New York)—Has acquired Amalgamated Phosphate Co.'s pebble-phosphate properties and will install equipment to double output. Product will be sent to company's new plant on New York harbor where cyanamid, made at Niagara Falls, will also be assembled for the production of a new fertilizing material, "Ammo-Phos," containing ammonia and phosphoric acid.

GEORGIA

MINEROIL CO. OF NEW YORK, INC. (1234 Tribune Bldg., New York)—Boggs Branch gold property will be operated by this company under direction Dr. A. H. Malaney. Dam to develop hydro-electric power is to be built across Etowah River on company property.

IDAHO

Blaine County

WILBERT (Arco)—Winze from 600-ft. level is down 100 ft. in lead-silver orebody 1 to 6 ft. wide. First-class ore being shipped; mill run on accumulating second-class ore will be made soon. H. S. Knight, Kearns Bldg., Salt Lake City, Utah, manager.

Bonner County

IDAHO CONTINENTAL CO. (Klockmann)—New 300-ton mill, operating from Aug. 15 to Jan. 15, produced 1875 tons of concentrates carrying 25 to 30 oz. Ag and 60 to 70% Pb; mill ran only 12 hours daily owing to lack of water power; additional power unit to be added. A. Klockmann, president.

Shoshone County

HECLA (Burke)—First car of zinc ore recently shipped from Oronogo vein. Company has been large producer of lead and silver. The zinc ore is being obtained from eastern section of the property.

STAR MINING (Wallace)—This property, comprising nine patented and seven unpatented claims, west of the Federal Mining and Smelting Co.'s Morning mine, has been idle for years, but recently over a dozen men were put to work. Mine openings consist of two adits with numerous drifts and crosscuts which opened considerable low-grade lead ore. Morning mine in drifting west on its 800 level encountered good ore. It is understood that suit will shortly be brought against the Federal company for ore trespass and that the work now being done at the Star is to secure necessary evidence. E. H. Moffit, manager. (Later—Suit for $500,000 filed at Boise, Mar. 1.)

MAINE

Hancock County

HOLMAN MOLYBDENITE (Rockland)—This disseminated molybdenite deposit on a granite hill in Township 10 has been opened by quarry 90x200 ft., besides several smaller opencuts ½ mi. west and two shallow shafts about 100 ft. to the north, these exposures indicating an average tenor of about 1% MoS_2. Now preparing to erect first milling unit. About 9 mi. from Franklin station on Maine Central R.R. M. R. and C. Vey Holman, owners.

MICHIGAN

Copper

ADVENTURE (Greenland)—Shipping about 200 tons daily. Stoping on second, third and sixth levels.

NORTH LAKE (Lake Mine)—New lode opened for about 100 ft.; revealed fair grade of rock.

MOHAWK (Mohawk)—Copper output in 1916 was 13,834,000 lb., comparing with 15,882,914 lb. in 1915; decrease due to labor shortage.

WOLVERINE (Kearsarge)—Copper production in 1916 was 6,185,753 lb., about the same as in 1915. Rock average 17.478 lb. per ton.

MASS (Mass)—Sinking from 13th level on Butler lode at C shaft. Producing about 1100 tons per day, yielding over 16 lb. per ton.

INDIANA (Rockland)—Down 225 ft. with shaft and will proceed to 300-ft. level, where drifting will be done in both directions to explore lodes of the Evergreen and Knowlton series.

ISLE ROYALE (Houghton)—Started work on No. 7 rockhouse; putting in new rock crusher. No. 2 unwatered to 30th level; not hoisting yet. Sinking suspended at No. 5 and No. 6 shafts in order to use men in mining.

NEW ARCADIAN (Houghton)—At 1500-ft. level, lode found to be regular and unbroken. Width of lode is 24 ft. on the angle of the crosscut and 20 ft. perpendicular to its walls. Sinking to the 1625-ft. level will be commenced as soon as the new rockhouse engine arrives.

CALUMET & HECLA (Calumet)—This company and subsidiaries now using about 3000 tons of coal daily. Contract let for large coal bridge at Hubbell coal docks, raising capacity from 200,000 to 500,000 tons per annum; Union dock at Dollar Bay, serving C. & H. subsidiaries, has capacity of 300,000 tons.

MINNESOTA

Cuyuna Range

FEIGH property in Sec. 10, 46-29 is being developed by shaft sinking and hydraulic stripping. West quarter will be operated by the Hill Mines Co. as a pit-continuation of the Hill Crest mine. Remainder of property will be mined underground by the Jefferson Iron Mining Co. The estimated tonnage from drill explorations is 6,114,375 tons averaging 56.68% Fe and 0.260% P. Approximately 1,000,000 tons will be mined by openpit. Jefferson company is sinking a 13x18-ft. lagged shaft through 85 ft. of sand and expect to develop main level at 165 ft. Orders have been placed for electric equipment which include one 50-kw. General Electric rotary converter, one two-ton conical-drum, electric ore hoist, one electric cage hoist, two electric locomotives.

BRAINERD CUYUNA (Brainerd)—The partly developed property in Sec. 36, 45-31, has been leased to an Eastern furnace company on a royalty of 35c. a ton.

Mesabi Range

YORK (Nashwauk)—Construction of washing plant started; will be similar to that of the Crosby.

ALBANY (Hibbing)—New shaft being sunk. Equipment for screening plant purchased.

BRAY (Keewatin)—Mining resumed, after idleness of three years.

MISSOURI

Joplin District

TREECE, KAN., is newest mining camp in this district. It lies directly west of Baxter Springs, about 6 miles, and is coming into prominence through development operations of the Butte & Superior company on territory in this vicinity.

FRANK SPONABLE (Alba)—New mill at Neck City will start soon. Old Little Mary plant enlarged and improved. Gas engines furnish power.

McDONALD BROS. (Webb City)—New mill on Connor land at Prosperity in operation. Rich disseminated formation at 196-ft. level, with sheet ground below.

LUCKY KID (Tar River, Okla.)—Purchased for $35,000 a 40-acre lease on Hocker land, 3½ miles southwest of Baxter. Extensive drilling indicates ore run.

FLANNERY ZINC (Sarcoxie)—Shovelers placed in ground and mill started Mar. 5, after idleness at mine since mill burned Dec. 2. Three Diesel oil engines used.

LEAD AND ZINC DEVELOPMENT (Miami, Okla.)—Starting shaft and will erect mill on tract, 1 mile northeast of Quapaw, Okla. Several drill holes show ore from 166 to 180 ft.

TULSA LEAD AND ZINC (Joplin)—Completed improvements at No. 1 mill in South Joplin and will start again; idle since December. No. 2 plant also in operation. Shaft at No. 1 sunk 15 ft. deeper.

WADE MINING AND MILLING (Joplin)—Has quit working tailing at property between Diamond and Tipton Ford and is going into old drifts. Draining completed. Evans W. Buskett, Joplin, treasurer.

SYMMES (Joplin)—Have connected mill, near Prosperity, with new Dixie shaft by 480-ft. tram. Now sinking third field shaft, southeast of mill, where recent drill hole showed rich blende cuttings for 13 ft.

SEQUOYAH (Joplin)—Has sunk shaft into rich ore at new property northeast of Picher, Okla., near Kansas-Oklahoma state line. Moving old Sequoyah mill from Thoms Station to site and hope to begin operations Mar. 10. Jesse Short, Joplin, interested.

MONTANA

Beaverhead County

ORIGINAL, BANNACK (Bannack)—In Pioneer shaft, 35 ft. below present crosscut, a body of high-grade copper ore is being opened. Company is arranging for transportation of ore to Grant by the American Transportation Co., which is operating trucks for the Bannack Gold Mining Co. in the same district.

Mineral County

TARBOX (Saltese)—Recent reports from property highly encouraging. Vein, encountered 235 ft. from shaft, has been drifted upon and shows high lead, silver and zinc. East vein has width of 100 ft. on surface, impregnated with lead and zinc. Mine now equipped with uptodate machinery and expected to produce shortly.

Park County

JARDINE GOLD MINING AND MILLING (Jardine)—This company has acquired properties of Kimberly Gold Mining and Montana Consolidated companies, embracing over 300 acres and power plant, 40-stamp mill, cyanide plant, 150-hp. compressor and shops. Developing low-grade orebodies, but there also occur bunches of high-grade gold ore and pockets of scheelite. T. J. Welcker, superintendent. W. S. Hunnewell, president; H. C. Bacorn, vice-president and general manager; head office, Silver Bow Block, Butte.

Silver Bow County

SNOW BLOCKADE on the Butte Anaconda & Pacific Ry. compelled many Butte copper mines to close for day shift, Feb. 27, the bins becoming full before regular shipment to Anaconda could be made.

DAVIS-DALY (Butte)—At company's Colorado mine 250 tons of copper ore now being hoisted per day. Output will soon be increased. Shipments of rich ore from recently discovered vein on 2400 level gave returns of over $28,000 for one lot of five cars.

OTISCO (Butte)—Charles J. Stone, formerly of the Butte-Alex Scott mine, has taken over the Otisco, one of Butte's old-time mines with a view of exploiting its silver ores. It is 600 ft. southwest of Anaconda's Belmont mine and is one of the Largey estate mines. Old workings on 100 and 200 levels will be unwatered and explored for orebodies which at present price of silver should prove profitable.

BUTTE & ZENITH CITY (Butte)—High price of silver has prompted company to develop the Emily and Corinthian veins in northern part of property, the Emily vein having in past days furnished rich silver ore. New veins encountered on 1000-ft. level carry both copper and silver. Electric pump purchased from Butte & London will be installed at 1000-ft. station, after which sinking to 1500 level will be started.

ANACONDA (Butte)—At this company's West Colusa mine, William D. Lewin, a boss trammer, was overcome by gas on the fourth floor of the 1000-ft. level, on Feb. 28, and died while being brought to the surface by helmet men. Frank McPherson who was with him at the time, managed to get down to level below and give warning. Mine officials unable to account for the gas, but stated it might have come from unconquered mine fires of 25 years ago which still rage in the district. Presence of gas not reported in any other mines.

NEVADA

Lander County

COPPER CANYON MINING CO. (Battle Mountain)—This old Glasgow & Western property now being developed by new company. Taking out 100 tons daily, much of which is of shipping grade; stoping ore from two levels—above the 113-ft. and the 188-ft. levels. Pumping out old 500-ft. shaft. Officers and directors are: R. M. Atwater, Jr., president; C. C. Burger, vice-president; L. E. Whicher, treasurer; F. Pelz, secretary; and Herman Aaron. F. Sommer Schmidt, manager.

Lincoln County

PRINCE CONSOLIDATED (Pioche)—Weekly shipments have lately been running between 2500 and 3000 tons.

GROOM (Indian Springs via Las Vegas)—Tom McCormac, of Las Vegas, lessee, shipping 60 tons per week of lead-silver ore by tractors and trucks to Indian Springs station, 60 miles. In 1916 shipments amount to 1455 dry tons.

Nye County

TONOPAH ORE PRODUCTION for week Feb. 24 was 10,312 tons, valued at $185,616, comparing with 9598 tons during the previous week. Producers were: Tonopah Belmont, 2906 tons; Tonopah Mining, 3000; Tonopah Extension, 2380; Jim Butler, 800; West End, 648; Rescue, 191; Hallfax, 210; Montana, 100; Midway, 57; and the Cash Boy, 20 tons.

TONOPAH EXTENSION (Tonopah)—January receipts $163,827; expenses, $92,701; operating profit, $71,126.

WHITE CAPS (Manhattan)—Recent ore strike on 100-ft. level followed down to 435 level, ore improving in value. Tests have shown that realgar can be eliminated by roasting which will be followed by cyaniding. Mill to be ready early in summer.

NEW JERSEY

HOFF MINING AND REALTY IMPROVEMENT (Wharton)—Surface cave occurred at this iron mine, 3 miles from Wharton, on Mar. 5, caused considerable damage. Subsidence covered area of about one acre and maximum depth reported to be 150 ft.

UTAH

Beaver County

LEONORA (Milford)—Meeting called to consider increasing capitalization from 1,000,000 shares par value 10c. to 1,500,000, par value remaining same. John Matson, president.

MOSCOW (Milford)—Mine produced 35 cars of ore (about 1600 tons) during last four months: November, 14 cars; December, 5; January, 5; February, 10 cars. Shipping both lead and zinc ores; in February, 3 cars zinc (running 30%), and 7 cars lead. Drifting being done from bottom of 1400-ft. shaft, recently completed to connect with old workings.

Juab County

TINTIC SHIPMENTS in February amounted to 737 cars as compared to 802 cars in January. Reduction due to heavy snows. Conditions especially unfavorable during week ended Feb. 24, some mines being forced to suspend for two or three days or to restrict operations.

KNIGHT RAILROAD SNOWBOUND for several days forcing Colorado, Iron Blossom, and Dragon Consolidated mines to remain closed.

TINTIC STANDARD (Eureka)—Work resumed after shutdown of few days due to inability to get coal to mine from station, owing to heavy snows.

EAGLE & BLUE BELL (Eureka)—Report for 1916 shows net earnings of $154,776 as compared with $143,345 in 1915. During year two dividends of 5c. each, amounting to $89,314, paid. Production amounted to 5,815,776 lb. lead as compared to 8,275,734 lb. in 1915; 347,501 oz. silver as compared to 441,268 oz. in 1915; gold, 987 oz. as compared to 1228 oz. in 1915.

CHIEF CONSOLIDATED (Eureka)—Work of enlarging shaft will be completed in about two months. Will give three compartments to 1800 ft. or water level. Owing to stormy weather, and consequent difficulty in procuring coal, ore production almost at standstill with orebins full during week ended Feb. 24. Shipments held down for several weeks by car shortage. Preparing to install pumping plant to be used when work below water level is undertaken on completion of shaft.

Salt Lake County

UTAH COPPER (Bingham)—January production 13,913,811 lb.—heaviest of any January so far. Previous high record for month—January, 1916—was 11,999,910 lb.

BINGHAM MINES (Bingham)—Gross earnings for 1916, $251,422 as compared to $236,792 in 1915. Dividends on company's holdings in Eagle & Blue Bell of Tintic were $65,912. Surplus $185,159 as compared to $197,923 in 1915.

BOSTON DEVELOPMENT (Salt Lake)—New find at bottom of 1800-ft. incline in old Maxfield mine in Big Cottonwood—operated under bond and lease by company—reported to be yielding 15 tons of ore daily. Fifty-five men being worked.

Summit County

PARK CITY SHIPMENTS for February, 6304 tons as compared to 6943 tons in January; difference due to bad weather.

IOWA COPPER (Park City)—Installation of machinery practically completed. Mining to be resumed soon. February shipments 135 tons.

ONTARIO (Park City)—Shaft again in working order. Preparing to unwater from 1500 to 1700; work at depth to be resumed soon by company. Lessees to number of 120 at work in upper workings. February production 560 tons.

CANADA

Ontario

ORE SHIPMENTS from Cobalt in January over the Temiskaming & Northern Ontario Ry., are reported by Arthur A. Cole, mining engineer, as follows: Aladdin, 21 tons; Beaver, 42; Conlagas, 55; Cobalt Comet—by Dom Red. Co., 58; Crown Reserve—by Dom. Red. Co., 97; Hudson Bay, 32; Kerr Lake—by Dom. Red. Co., 99; LaRose, 131; McKinley-Darragh, 138; O'Brien, 85; Penn Canadian, 83; Right-of-Way, 41; Temiskaming, 41; Trethewey, 42; total, 927 tons; Cobalt ore containing no silver, Aguanico (North Cobalt), 26.60 tons; nickel ore, Alexo (Porquis Junction), 515 tons; asbestos, Slade & Forbs Asbestos Co. (South Porcupine), 1 ton.

THOMPSON-KRIST (Porcupine)—Diamond-drill hole, at angle of 45°, stated to have cut 75 ft. of quartz carrying gold.

TECK-HUGHES (Kirkland Lake)—Power now being received from new transmission line. The 80-ton ball mill is in operation.

RAND CONSOLIDATED (Cobalt)—Copper opened on No. 2 property; the sulphides running about 31%. Five or six tons a day being taken out.

HURD (Kirkland Lake)—On this claim, being developed by the La Rose, vein is 12 to 15 ft. wide at 50-ft. level, with some showings of free gold.

WEST DOME CONSOLIDATED (Porcupine)—Steam plant superseded by electricity. Drifting on main vein at 300-ft. level has been continued for 500 ft.; average width 5 ft. reported. A winze will be put down to 400-ft. level.

MINING CORPORATION OF CANADA (Cobalt)—The headquarters, now in England, are shortly to be removed to Toronto. Car of high-grade ore recently shipped, estimated to contain 227,000 oz. of silver and is said to be most valuable carload ever sent out of the camp.

HOLLINGER CONSOLIDATED (Timmins)—Report for four weeks, ended Jan. 28, shows gross profits of $217,100, from 48,119 tons; average value $8.71; working cost $3.88 per ton milled. Mill ran 85.5% of possible time. Deficit had creased to $298,490. Dividend cut one-half Mar. 6, or to 1% in eight weeks.

PETERSON LAKE (Cobalt)—Long-continued contest for control resulted in the retirement of old directors excepting the president, Sir Henry M. Pellatt. Three new directors—W. A. Lamport, S. G. Forst and Charles M. Mickel—were elected, and it is understood that at next meeting M. B. Borg and Irving Ermst, both of New York, will be added to the board.

MEXICO

BOLEO (Santa Rosalia)—January copper output 1,982,400 lb.; average grade of ore 3.39%.

MEXICO MINES OF EL ORO (El Oro, Mex.)—Declared dividend of 7s. per share payable Mar. 14—first since June, 1914. Figures for year ended June 30, 1916, just available, showed loss of £21,855; unappropriated profit carried forward £50,072; ore reserves, 505,300 tons averaging $10.40 in gold and 6.4 oz. silver. Development has been continued on small scale. Mill started in August, 1916, and to end of December had treated 31,000 tons. Issued capital, June 30, 1916, was £180,000; since then British and French authority obtained to issue 30,000 shares for the Oro Nolan property.

AMERICANS RETURNING to Sonora and a number of mines preparing to resume. A recent letter from an engineer at Hermosillo states: "Over a dozen Americans came in on today's train. La Colorado gold mine is starting up again. About 40 miles farther east, an Oklahoma company is starting its silver mines. About 30 miles northwest of Hermosillo, another silver mine is preparing to erect a reduction plant. A man who arrived from the North on today's train told me there were three cars of mining machinery for Sonora mines on the sidetrack on the Mexican side of the line. From this you will see that the Villa trouble in Chihuahua is having little effect on conditions in Sonora."

NICARAGUA

TONOPAH-NICARAGUA CO. (Bluefields)—This subsidiary of Tonopah Mining Co., of Philadelphia, U. S. A., is developing the Santa Rita mine and it is reported has option on the Bonanza mine, which will be examined by J. E. Spurr, while he is in Nicaragua, with the Tonopah officials to observe the starting of the Eden mill, expected late in March.

RUSSIA

LENA GOLDFIELDS, LTD., (441 Salisbury House, London, Eng.)—Directors have accepted offer from un-named "responsible parties for purchase of 41,000 shares of company's Lenskoie holdings at 450 rubles or, in certain events, £30 per share, payable in three annual installments." Presumably to provide funds for dredging and other proposed extensions of the Siberian operations. Details to be given out at annual meeting.

BELGIAN CONGO

UNION MINIERE DU HAUT KATANGA (Lubumbashi)—January copper output 1472 tons; plant closed few days early in month for repairs; last week's output was 523 tons.

SOUTH AFRICA

MEYER & CHARLTON (Johannesburg)—Strike of white miners, comprising 31 men, occurred Feb. 7, because two skipmen refused to join union. First time "open shop" issue has been raised here.

CHOSEN

ORIENTAL CONSOLIDATED (Unsan)—Cable estimate February cleanup $132,232.

The Market Report

Metal Markets

SILVER AND STERLING EXCHANGE

Mar.	Sterling Exchange	Silver New York, Cents	Silver London, Pence	Mar.	Sterling Exchange	Silver New York, Cents	Silver London, Pence
1	4.7513	76⅛	37 7/16	5	4.7513	76⅛	37 7/16
2	4.7500	76¼	37⅜	6	4.7513	76⅛	37 7/16
3	4.7513	76⅛	37 7/16	7	4.7507	75½	37 7/16

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Mar.	Copper Electrolytic	Tin Spot.	Lead N. Y.	Lead St. L.	Zinc St. L.
1	31½ @33	52	8½ @9½	8½ @9¼	9¾ @10¼
2	31½ @32½	53½	9 @9½	9 @9½	10 @10½
3	31½ @32½	53½	9 @9½	9 @9½	10 @10½
5	31½ @32½	54	9 @9½	9 @9½	10 @10½
6	31½ @32½	54	9 @9¾	9 @9¾	10 @10½
7	31½ @32½	54	9 @9¾	9 @9¾	10 @10½

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

The quotations for electrolytic copper are for cakes; ingots and wirebars. Electrolytic copper is commonly sold on "regular terms" (r.t.), including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 17c. per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1 cents.

LONDON

Mar.	Copper Standard Spot	Copper Standard 3 Mos.	Copper Electrolytic	Tin Spot	Tin 3 Mos.	Lead Spot	Zinc Spot
1	139	136½	151	200	200	30½	47
2	139	136½	151	199½	199½	30½	47
3							
5	139	136½	151	200¼	200¼	30½	47
6	139	136½	151	201	201	30½	47
7	139	136½	151	202¼	201¾	30½	47

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21⅞c.

NEW YORK—Mar. 7, 1917

The metal markets were again characterized by relatively little business, but well sustained strength. The price of lead advanced, and spelter, which at the close of last week was exhibiting a little weakness, turned strong again.

Copper, Tin, Lead and Zinc

Copper—Business in copper for delivery in the third quarter of 1917, the development of which business on a fair scale was reported by us last week, continued. Although this business did not attain large proportions, and, indeed, was far short of satisfying producers (who are becoming somewhat impatient), there were several sales of lots of a million pounds and over. This business was done at 32c., r.t., a round lot having been sold on Mar. 6 at that price. A round lot, for July delivery was sold at 32¼c., r.t., on Mar. 7. A large sale for delivery during the second half of 1917 was made at 31½c., net cash, New York, which was 1½c. higher than a similar sale in the previous week. Copper for prompt delivery continues to command all kinds of premiums, 37c., or even upward, being talked about, but transactions of that sort are quite insignificant. The major market at the present time is for third-quarter delivery. An important consumer was in the market last week for two million pounds for April-June delivery, but purchase of the copper was not reported.

On Mar. 5 there was a strike at the Nichols refinery, and on Mar. 6 the plant was tied up completely. The men simply walked out without making any demands, and up to Wednesday noon the company did not know what they wanted. The trouble seems to have started with an I. W. W. agitation.

Exports of copper from Atlantic ports for February totalled 24,937 tons, against 20,548 a year ago.

Copper Sheets—Although some manufacturers have advanced the base price from 42 to 44c., the principal roller has not advanced his price. We quote 42@44c for hot rolled, cold rolled 1c. higher. Wire remains at 37c. f.o.b. mill.

Tin—There was a fair demand, and this market still being very sensitive, prices advanced.

The steamer "Ventura" was reported arrived at San Francisco on Mar. 1 with 3749 ingots of tin, and the "Shinyo Maru," on the same day, with 100 cases of tin.

Lead—On Mar. 2 the American Smelting and Refining Co. raised its price to 9c. During that part of the week there was less inquiry from consumers, but on Mar. 5 a more active demand developed. However, the total transactions for the week were not large Those reported to us consisted chiefly of contracts for April delivery. March business was much less in volume. Some business for April-May delivery was reported. Prices varied widely, according to delivery and according to place, the lead market being still in a state of great confusion. The St. Louis price seems to be about on a par with New York, while at other points prices may be relatively higher owing to difficulty of getting in lead. The railroad congestion seems to be easing a little, and some consumers are exhibiting less nervousness, although there are still some who are quite excited and grabbing lead when they can get it.

Zinc—The market advanced rather sharply on what looked like speculative buying, not much business with consumers being reported.

The American Metal Co. has exercised its contractual right to take entire ore output of Butte & Superior, a portion of which has heretofore been going to Caney and Dearing, where it has been smelted on toll.

Zinc Sheets—No change has been made in market price. Quotation is $21 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

Other Metals

Aluminum—The aluminum market is still quiet. Some sales are said to have been made at 59c. and some slightly higher. We quote the same as last week, 58@60c. per lb. for No. 1 ingots, New York.

A cablegram from the American consul general at London states that the Ministry of Munitions directs all persons controlling aluminum to report monthly stocks in hand or controlled and all contracts requiring use of aluminum for execution.

Antimony—Market is steady with fair business at slight recession in price for spot; we quote 30@31c. February-March shipment from China quoted at 16½@17c., and March-April shipment 15½@16c., c.i.f., New York, duty unpaid. The antimony market is in a somewhat mysterious condition. There has been but little buying by consumers during the last month, the major part of the transactions having been with dealers. There are suspicions of some stock locked up in this market, yet nobody seems to be able to locate it, if there be any, and certainly it has not yet showed signs of coming out.

Nickel—The nickel quotation has not been changed. The market is steady, with price at 45@50c. per lb., electrolytic commanding an additional 5c. per lb.

Quicksilver—Price has dropped gradually throughout the week, owing to lack of demand. We quote today $108@110. San Francisco reports by telegraph $110, moderate.

Gold, Silver and Platinum

Gold—The net import of gold into India for January, 1917, was £565,600.

Gold bullion amounting to about $11,000,000 taken over by New York Federal Reserve Bank last week out of a Canadian assignment to J. P. Morgan & Co. and stored in its vaults has been turned in at the assay office. Apparently acquiring of the bullion originally by Federal Reserve Bank was for purpose of affording an immediate credit for the gold.

Silver—No new features in silver. Market very quiet. Shipments to London very irregular, owing to uncertain sailings. About 900,000 ounces silver bullion went down with the sinking of the "Laconia." Shipments to India for week ending Feb. 21 estimated at £1,153,000. China Exchanges are reported still below silver parity.

The market at London, according to a report from Samuel Montagu & Co., London, under date of Feb. 8, was firm. A steady upward movement in price culminated in reaching 37 5/16 d. per oz., the highest quotation since June, 1893. In 1892 silver reached 43¾d., and in 1891, 48¾d., and in 1890, 54⅝d.

It is an interesting fact that the value of the silver imported into this country in 1890, was practically the same as that of the year 1915, but on the other hand the amount of silver coined in England during the latter year was nearly £8,000,000, against £1,700,000 in 1890, leaving a balance for other purposes of £8,800,000 in 1890, against about £2,750,000 in 1915, the last figures completely available.

Mexican Dollars at New York, Mar. 1, 59⅜@62⅜; 2, 59@62c.; 3, 58¾@61¾c.; 5, 58¾@61¾c.; 6, 58¾@61¾c.; 7, 58¾@61¾c.

Platinum—We quote the market unchanged at $100@105 per oz.

Palladium—Quoted at $85 per oz.

Zinc and Lead Ore Markets

Platteville, Wis., Mar. 3—Blende, basis 60% Zn, $90 for premium ore down to $85 for medium grade. Lead ore, basis 80% Pb, $113 per ton. Shipments for the week are 2600 tons of zinc ore, 193 tons of lead ore, and 422 tons of sulphur ore. For the year to date the figures are: 23,570 tons of zinc ore, 701 tons of lead ore, and 3854 tons of sulphur ore. Shipped during week to the separating plants, 2977 tons of zinc ore.

Joplin, Mo., Mar. 3—Blende, per ton, high $93; 60% Zn, premium ore, $92@90; medium to low; $90@80. Calamine, 40% Zn, $55@50. Average selling price, all grades of zinc, $83.29.

Lead, per ton, high $130, base 80% Pb $126@116. Average selling price, all grades of lead, $117.32.

Shipments the week: Blende 9428, calamine 1010, lead 1255 tons. Value, all ores the week, $1,016,430.

Some shippers are finding relief from the freight embargo, while others have not received benefit. A buyer for the Missouri Refining and Chemical Co. of St. Louis, appeared in this market two weeks ago and his first consignments were made this week. A buyer for a firm in Ohio has sent word he will be here soon to secure ore. Both are new in this field. The hydro-electric company is promising power relief early next week. But with the additional power there is found a shortage of labor to offset the expected increase in production.

Other Ores

Antimony Ore—Some ore from South America has been bought, but continuance of this business is uncertain. The quotation remains at $2.30 per unit.

Molybdenum Ore—There is still a great scarcity and such small lots of molybdenite and wulfenite as reach the market are eagerly taken at high prices. Business in wulfenite was done on Mar. 5, at $2 per lb.

Tungsten Ore.—A large volume of business was reported at about $17 per unit, which we quote as the market.

Charles Hardy reports as follows, under date of Mar. 6: "The market continues exceedingly firm and the position has developed further on toward an improvement of prices. The large order referred to in my previous report has in the meantime been placed and the New York stocks of high-grade ore are practically wiped out. Besides, ore on the way to New York is now already under option to the buyers. At the present moment of writing, wolframite has

realized again $17. Shipments from South America are not as heavy as they used to be, as in the Argentine as well as in Peru and Bolivia, Great Britain, France and Italy are competing against each other for the securing of supplies. As a matter of fact, to discourage shipments to this country, the Allies have paid in South America, f.o.b. South American port, prices at which tungsten ore could have been bought f.o.b. New York. A six-months' contract was closed in South America at prices of about $16.65 f.o.b. South American shipping point, and negotiations for further contracts to cover the whole of this year are now in process. Should shipments from South America remain as low as they have been during the last month, the chances are that our home supply will be called upon to fill the market needs and this should work toward a higher level of prices. Ferberite and scheelite have again realized $18, with wolframite now up to $17."

Iron Trade Review

NEW YORK—Mar. 7

Belief in early Government purchasing on a war footing scale seems to be the underlying reason for the sharp advances and continued strength of both iron and steel markets, according to "Iron Age." Facing the possible Government preemption of space in mills, after suffering the curtailment of output, particularly throughout February, amounting to perhaps 30% as an estimated average, both pig iron and finished steel are sensitive to even expected buying of consumers.

PITTSBURGH—Mar. 6

The heaviest snowfall of the season occurred in this general district on Sunday and railroad operations were greatly hampered but conditions are already improving and by next week are expected to be better than at any time during the winter. The mills shipped a trifle more steel last week than the week before, but still have large accumulations.

Iron and steel pipe have been advanced two points or about $4 a ton, effective Mar. 5, the advance covering also line pipe and oil country goods. The long expected advance in wire products was announced yesterday, $4 a ton, making nails $3.20, base. Pittsburgh iron mills have advanced refined iron bars $5 a ton to 3.50c. and chain is up $10 a ton to a basis of 6.50c. Predictions are that bars, plates and shapes will shortly be advanced. Altogether, steel prices have been advancing more rapidly since the middle of December than they did on an average during the two years preceding, despite the fact that the market has had an appearance of quietness.

There is a stronger disposition on the part of consumers to cover requirements to the end of the year in all materials, a disposition attributed to the prospect of war. In finished steel products generally there is a desire on the part of regular consumers to cover for additional periods, and a large volume of business has been put through, although as to definite orders for specific requirements, such as bridges, buildings, etc., conditions have been very quiet. The automobile and agricultural implement makers have lately covered largely on steel bars for second half, but sheet mills have refused to sell them much of their product.

Pig Iron—The deadlock as to second half foundry iron, arising from quotations being so much higher than for basic iron, which costs about the same to make, appears to have been broken, as three sales for second half, aggregating over 5000 tons, have been made at $35, valley, and one sale is reported at $36. An advance in basic iron is predicted, but thus far it has been selling for all deliveries at $30, valley, and Messrs. W. P. Snyder & Co.'s computation of the average for February shows $30 flat, while the bessemer average was $35.418, January averages having been $30 and $35 respectively. Foundry iron was nominally quotable at $30 through the month, for forward delivery, but prompt brought an average of $35, valley. A fortnight ago southern foundry iron was $24, Birmingham, but in the past week practically all producers have either withdrawn from the market or advanced to $30, Birmingham, equal to $34.55 delivered Pittsburgh. We quote: Basic, $30; bessemer, prompt, $36; forward, $35; foundry and malleable, prompt, $36@38; forward, $35@36, all f.o.b. valley furnaces, 95c. higher delivered Pittsburgh.

Ferroalloys

Ferromanganese—The scarcity continues, quotations on domestic, delivered, being $300 for prompt or first half, $275 for third quarter and $250 for fourth quarter. Most English producers have withdrawn quotation $185, seaboard.

Ferrotungsten—Business is reported as having been done at $1.75@2 per lb.

Ferromolybdenum—Manufacturers are reported far behind with their deliveries, owing to shortage of raw material.

Coke

Connellsville—The market is easier, despite Sunday's big snowfall, with spot furnace $10.50 all and spot foundry $13@14, per net ton at ovens. Two or three producers have been selling second half foundry at $7 but have now withdrawn and the market is $7.50@8.50.

STOCK QUOTATIONS

N. Y. EXCH.†	Mar. 6
Alaska Gold M.	7⅛
Alaska Juneau	7⅛
Am. Sm. & Ref., com.	100⅛
Am. Sm. & Ref., pf.	111⅛
Am. Sm. Sec., pf. A	100⅛
Am. Sm. Sec., pf. B.	95⅞
Am. Zinc	38⅛
Am. Zinc, pf.	69
Anaconda	84⅛
Batopilas Min.	1
Bethlehem Steel	140
Bethlehem Steel, pf.	117⅛
Butte & Superior	49⅛
Cerro de Pasco	39⅛
Chile Cop.	23⅛
Chino	62⅞
Colo. Fuel & Iron	48⅛
Crucible Steel	66⅛
Dome Mines	19⅛
Federal M. & S.	15
Federal M. & S., pf.	‡41
Great Nor., ore ctf.	37
Greene Cananea	44
Homestake	127
Inspiration Con.	60⅛
International Nickel	42⅛
Kennecott	47⅛
Lackawanna Steel	83⅛
Miami Copper	41⅛
Nat'l Lead, com.	58⅛
National Lead, pf.	111
Nev. Consol.	26
Ontario Min.	5⅛
Quicksilver	2⅛
Quicksilver, pf.	2⅛
Ray Con	30⅛
Republic I. & S., com.	80⅛
Republic I. & S. pf.	102
Sloss-Sheffield	63¾
Tennessee C. & C.	15
U. S. Steel, com.	110⅜
U. S. Steel, pf.	118
Utah Copper	115
Va. Iron C. & C.	59½

N. Y. CURB†	Mar. 6
Buffalo Mines	1⅛
Butte & N. Y.	2⅜
Butte C. & Z.	10¼
Caledonia	.64
Can. Cop. Corpn.	1¾
Carlisle	6
Cashboy	.06½
Con. Ariz. Sm.	2⅛
Con. Coppermines	3⅛
Con. Nev.-Utah	⅛
First Nat. Cop.	3
Goldfield Con.	.60
Goldfield Merger	.07½
Granite	.25
Hecla Min.	7 13/16
Howe Sound	7⅛
Jerome Verde	2⅜
Joplin Ore & Spel.	.30
Kerr Lake	4⅛
Magma	50
Majestic	⅛
McKinley-Dar-Sa.	.55
Mother Lode	.39
Nevada Hills	.22
N. Y. & Hond.	15⅛
Nipissing Mines	8
Ohio Cop.	1⅛
Ray Hercules	4⅛
Rochester Mines	.58
St. Joseph Lead	19
Seneca	13
Standard S. L.	.75
Stewart	⅛
Success	.53
Tonopah	6⅛
Tonopah Ex.	3 13/16
Tribullion	⅛
Troy Arizona	.60
United Verde Ext.	39
United Zinc	.5
White Knob, pf.	1⅞
White Oaks	2
Yukon Gold	2

SAN FRAN.*	Mar. 6
Alta	.03
Andes	.17
Best & Belcher	.04
Bullion	.01
Caledonia	.15
Challenge Con.	.05
Confidence	.04
Con. Virginia	.19
Gould & Curry	.03
Hale & Norcross	.04
Jacket-Cr. Pt.	.04
Mexican	.09
Occidental	.65
Ophir	.03
Overman	.03
Savage	.08
Seg Belcher	.02
Sierra Nevada	.07
Union Con.	.44
Utah Con.	.01
Belmont	4.35
Jim Butler	.73
MacNamara	.08
Midway	.17
Mont.-Tonopah	.24
North Star	.15
Rescue Eula	.25
West End Con.	.70
Atlanta	.13
Booth	.11
Comb. Frac.	.04
D'field B.B.	‡.02
D'field Daisy	.03
Florence	.20
Jumbo Extension	.26
Kewanas	.20
Round Mountain	.42
Silver Pick	.11
Argo	.05
Ariz. Central	.10
Big Jim	1.25
Lazy Boy	.06
Nellie	.18
Tom Reed	2.06½
United Eastern	4.87½
United Western	.02

BOSTON EXCH.*	Mar. 6
Adventure	3½
Ahmeek	105
Algomah	.95
Allouez	69½
Ariz. Com., ctfs.	13¾
Bonanza	.30
Butte-Balaklava	1⅛
Calumet & Ariz.	83⅝
Calumet & Hecla	555
Centennial	22
Copper Range	66
Daly West	3½
Davis-Daly	6
East Butte	14⅜
Franklin	8½
Granby	88
Hancock	18½
Hedley	16
Helvetia	.42
Indiana	3
Island Cr'k, com.	64⅜
Isle Royale	33⅜
Keweenaw	3
Lake	14⅛
La Salle	3⅛
Mason Valley	5⅛
Mass.	14⅛
Mayflower	2⅛
Michigan	3⅛
Mohawk	85⅛
New Arcadian	4½
New Idria	15
North Butte	22⅞
North Lake	2
Ojibway	2
Old Colony	2½
Old Dominion	65⅞
Osceola	94
Quincy	88½
St. Mary's M. L.	89
Santa Fe	1⅛
Shannon	9⅛
Shattuck-Ariz.	28⅛
So. Lake	4½
So. Utah	27
Superior	16
Superior & Bost.	6
Tamarack	57½
Trinity	4 7/16
Tuolumne	1⅛
U. S. Smelting	62
U. S. Smelt'g, pf.	50½
Utah Apex	2⅝
Utah Con.	19
Utah Metal	5⅛
Victoria	5
Winona	4⅛
Wolverine	53
Wyandot	1⅛

BOSTON CURB*	Mar. 6
Alaska Mines Corp.	1⅛
Bingham Mines	10⅛
Boston Ely	.35
Boston & Mont.	.70
Butte & Lon'n Dev.	.25
Calaveras	4
Calumet-Corbin	.02½
Chief Con.	2 1/16
Cortez	.30
Crown Reserve	.35
Crystal Cop.	.85
Eagle & Blue Bell	2⅛
Houghton Copper	1
Iron Cap Cop., pf.	17
Mexican Metals	.22
Mines of America	1⅛
Mojave Tungsten	.50
Nat. Zinc & Lead	.54
Nevada-Douglas	2⅛
New Baltic	1⅛
New Cornelia	17¼
Oneco	.60
Pacific Mines	.35
Rex Cons	.34
Rilla	.05

SALT LAKE*	Mar. 6
Big Four	.63
Black Jack	.04½
Cardiff	5.00
Colorado Mining	.17
Crown Point	.04
Daly-Judge	8.60
Emma Cop.	1.37½
Empire Copper	1.50
Gold Chain	.16
Grand Central	.53
Iron Blossom	1.25
Lower Mammoth	.03
May Day	.09
Moscow	.12
Prince Con.	1.30
Seven Troughs	‡.03¾
Silver-King Coal'n	3.15
Silver King Con.	4.35
Sioux Con.	.14
So. Hecla	1.30
Uncle Sam	.04
Wilbert	.17
Yankee	.12½

TORONTO*	Mar. 6
Bailey	.05
Beaver Con.	.44
Chambers Ferland	.14
Coniagas	4.20
La Rose	.50
Peterson Lake	.12
Right of Way	.04
T. & Hudson Bay	43.00
Temiskaming	.57
Wettlaufer-Lor.	.08
Dome Exten.	.27½
Dome Lake	.19
Foley O'Brien	.68
Hollinger	5.20
Jupiter	.27
McIntyre	1.82
Newray	1.12½
Porcu. Crown	.66
Schumacher	.62
Vipond	.43
West Dome	.27

STOCK QUOTATIONS—Continued

COLO. SPRINGS	Mar. 6
Cresson Con.	6.00
Doctor Jack Pot	.08¼
Elkton Con.	.11
El Paso	.30
Findlay	‡.04
Gold Sovereign	.05
Golden Cycle	2.32½
Granite	.58
Isabella	.21¾
Mary McKinney	.27
Portland	1.75
Vindicator	.87

LONDON	Feb. 19		
Alaska Mexican	£0	12s	6d
Alaska Tre'dwell	2	10	0
Burma Corp.	4	0	0
Cam & Motor	0	9	9
Camp Bird	0	5	6
El Oro	0	7	6
Esperanza	0	7	9
Mexico Mines	4	10	0
Nechi, pfd.	0	12	6
Oroville	0	15	0
Santa Ger t'dis	0	9	0
Tomboy	1	0	0

* Bid prices. † Closing prices. ‡ Last Quotations.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1915	1916	1917	1915	1916	1917
January	48.855	56.775	75.630	22.731	26.960	36.682
February	48.477	56.755	77.585	22.753	26.975	37.742
March	50.241	57.935		23.708	27.597	
April	50.250	64.415		23.709	30.662	
May	49.915	74.269		23.570	35.477	
June	49.034	65.024		23.267	31.060	
July	47.519	62.940		22.597	30.000	
August	47.163	66.083		22.780	31.498	
September	48.680	68.515		23.591	32.584	
October	49.385	67.855		23.925	32.361	
November	51.714	71.604		25.094	34.192	
December	54.971	75.765		26.373	36.410	
Year	49.684	65.661		23.675	31.315	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1916	1917	1916	1917	1916	1917
Jan.	24.008	28.673	88.083	131.921	116.167	142.895
Feb.	26.440	31.750	102.667	137.895	133.167	148.100
Mar.	26.310		107.714		136.000	
April	27.895		124.319		137.389	
May	28.625		135.457		152.522	
June	26.601		112.432		137.455	
July	23.865		95.119		125.500	
Aug.	26.120		110.283		126.304	
Sept.	26.855		113.905		134.071	
Oct.	27.193		122.750		142.523	
Nov.	30.625		134.659		155.432	
Dec.	31.890		145.316		162.842	
Year	27.202		116.059		138.281	

Tin	New York		London	
	1916	1917	1916	1917
January	41.825	44.175	175.548	185.813
February	42.717	51.420	181.107	198.974
March	50.741		193 609	
March	51.230		199.736	
May	49.125		196.511	
June	42.231		179.466	
July	38.510		168.357	
August	38.565		169.870	
September	38.830		171.345	
October	41.241		179.307	
November	44.109		186.932	
December	42.635		183.368	
Av. year	43.480		182.096	

Lead	New York		St. Louis		London	
	1916	1917	1916	1917	1916	1917
January	5.921	7.626	5.826	7.530	31.167	30.500
February	6.246	8.636	6.164	8.595	31.988	30.500
March	7.136		7.375		34.440	
April	7.630		7.655		34.368	
May	7.463		7.332		32.967	
June	6.936		6.749		31.011	
July	6.352		6.185		28.137	
August	6.244		6.088		29.734	
September	6.810		6.699		30.786	
October	7.000		6.898		30.716	
November	7.042		6.945		30.500	
December	7.513		7.405		30.500	
Year	6.858		6.777		31.359	

Spelter	New York		St. Louis		London	
	1916	1917	1916	1917	1916	1917
Jan.	16.915	9.619	16.745	9.449	89.810	48.329
Feb.	18.420	10.045	18.260	9.875	97.762	47.000
Mar.	16.846		16.676		95.048	
April	15.695		16.525		99.056	
May	14.276		14.106		94.217	
June	11.752		11.582		68.591	
July	8.925		8.755		50.750	
Aug.	8.730		8.560		51.587	
Sept.	8.990		8.820		52.095	
Oct.	9.829		9.659		54.159	
Nov.	11.592		11.422		56.023	
Dec.	10.665		10.495		55.842	
Year	12.804		12.634		72.071	

New York and St. Louis quotations, cents per pound, London, pounds sterling per long ton. ¼ Not reported.

Pig Iron, Pitts.	Bessemer‡		Basic‡		No. 2 Foundry	
	1916	1917	1916	1917	1916	1917
January	$21.60	$35.95	$18.78	$30.95	$19.70	$30.95
February	21.16		18.93		19.51	
March	21.81		19.20		19.45	
April	21.65		18.95		19.45	
May	21.78		19.11		19.58	
June	21.95		18.95		19.34	
July	21.95		18.95		19.20	
August	21.95		18.95		19.22	
September	22.88		19.58		19.53	
October	24.61		21.26		21.51	
November	30.07		28.18		26.55	
December	35.16		30.95		30.79	
Year	$23.88		$20.98		$21.15	

‡ As reported by W. P. Snyder & Co.